ELECTRICAL REVIEW

[ILLUSTRATED]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 5, No. 11. WEEKLY. | NEW YORK, SATURDAY, NOVEMBER 15, 1884. | $3 per annum. Single Copies, 10 Cents

Copyright, 1883, by Electrical Review Publishing Company, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

The Brush-Swan Exhibit at the International Electrical Exposition, Phila.

A PRACTICAL ILLUSTRATION OF ALL THE FEATURES OF A COMPLETE ELECTRICAL SYSTEM GIVEN TO THE VISITORS TO THE EXHIBITION—THE BRUSH SYSTEM OF ARC LIGHTS—THE BRUSH-SWAN SYSTEM OF INCANDESCENT LIGHTS—THE BRUSH STORAGE BATTERIES—THE MANIPULATOR—THE BRUSH COMPANY'S MOTOR—THE ELECTRO-PLATER—LIGHTING UP STEAMSHIPS.

The most attractive and important exhibits at the International Electrical Exposition in Philadelphia were those of the electric lighting companies. Of these, some displayed only incandescent lights, others only arc lights, while others there were that exhibited the one as well as the other. All were made the subject of careful attention by the thousands who daily visited the great halls and corridors. It was, however, a discriminating audience, an audience familiar with the appearance of both arc and incandescent lights, but bent upon ascertaining what system was most practicable for commercial purposes; that is to say, for everyday use in close competition with gas. Hence it was that the Brush-Swan system became early in the day one of the chiefest objects of interest in the electric lighting department.

The Brush apparatus, as exhibited, furnished at the same time arc and incandescent lights in such numbers that no part of the great hall, either below or aloft, was free of the glowing lamps bearing the legend, "Brush System." The great gas burners placed here and there, recklessly consuming gas and wantonly vitiating the atmosphere, paled their ineffectual fires before the arc lights of the Brush Company, and the Brush-Swan incandescent lights glowed with the constancy of stars in a fixed sky. But, as might have been inferred from above, it was not alone because of the clearness and steadiness of these little lamps that drew to them so much attention, but rather of the means employed by the Brush Company to generate them. These lights, as could be seen, were not made to rely upon the steam engine, which, like all other complex mechanisms, is liable to accidents. On the contrary, they received their energy from electrical storage batteries, which, in turn, were charged by the arc wires. To the delight of the spectators, it was shown that these storage batteries could be charged during the day by the same wires which at night furnished the electric current for the arc lights, so that at night, when the lights were needed, they were not made to rely upon the engines from a central station at all. Indeed, they could be altogether disconnected, each dwelling or office being thus furnished with an independent source of electric energy within itself.

The advantages of this can scarcely be underestimated. Where incandescent lights get their energy from a central station direct, a whole household may be suddenly left in gloom and darkness by reason of an accident to the engine which is driving the dynamos in a central station; while with the Brush-Swan system the breaking down of the engines in the central station at night would not in any way affect the incandescent lamps

In order to practically exhibit the Brush-Swan system, a suite of two rooms—a bedroom and parlor—lighted by incandescent lamps, were exhibited by the Brush Company in the main hall. These incandescent lights were set in delicately wrought glass globes, and, instead of pointing toward the ceiling, as do gas jets, they concentrated their rays in a soft, mellow glow that spread downward and outward, steady and diffusive.

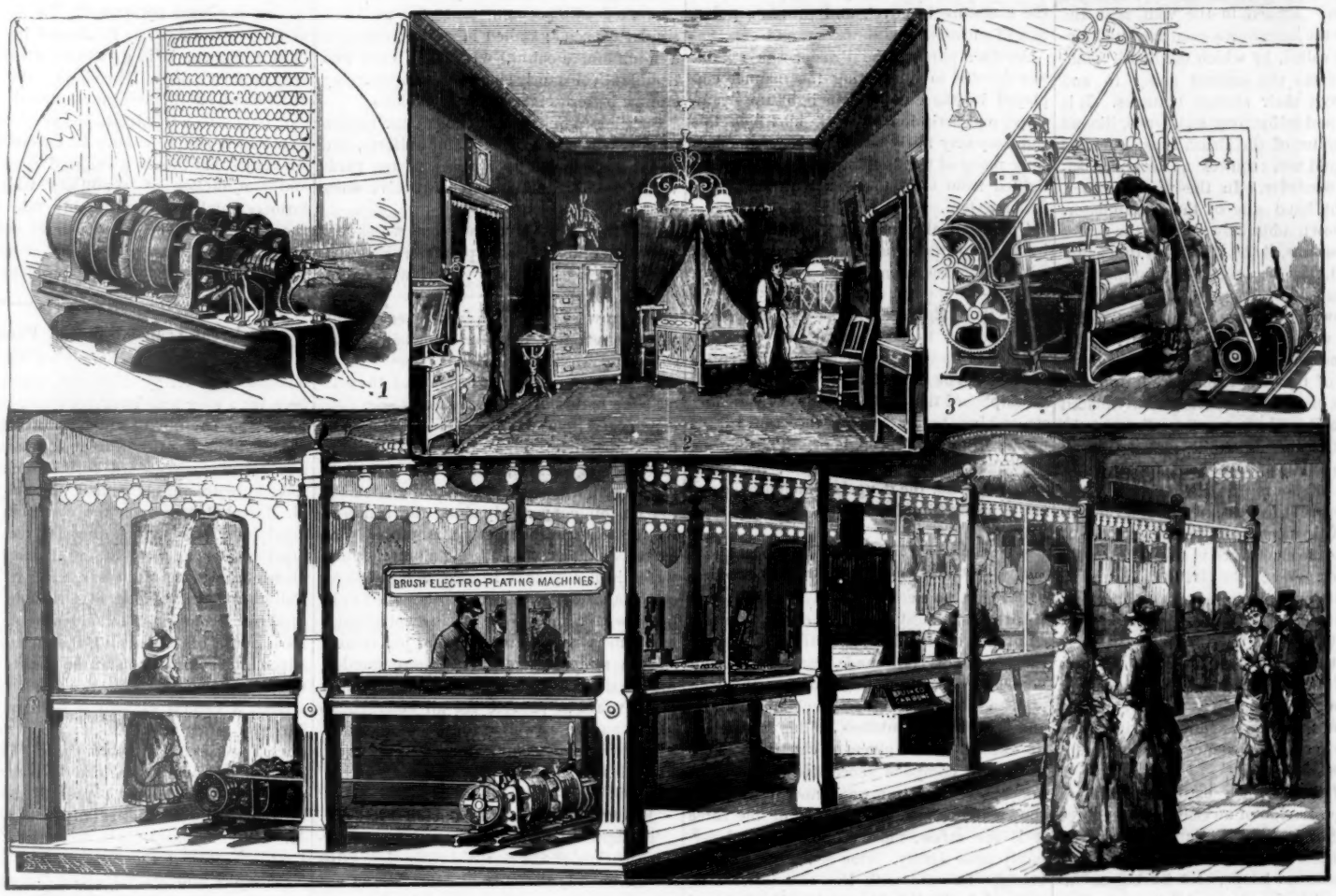
Adjoining their rooms a second apartment contained two looms operated by an electric motor of the Brush pattern. This motor is of most ingenious construction, and for all work requiring small power may be fed from the same wire that feeds the electric lamps. As was shown at the exhibition, it requires no care whatever, being as safe in the hands of a young woman or boy as it is in those of the engineer. It requires no fuel, no fire, and no water, and throws off neither smoke, steam, nor heat.

The headquarters of the Brush-Swan Company was encircled by myriads of incandescent lamps glowing in vari-colored globes, while at different points chandeliers—or, rather, electroliers—hung suspended from the ceiling and threw down an intense and never-varying light.

Though the Brush exhibit occupied a position in the northern part of the main hall, its wires extended, as said before, all over the building. Of arc lamps, the Brush Company exhibited ninety-three, each having an intensity of from 1,200 to 4,000 candle-power.

The care taken by the Brush Company to underestimate rather than overestimate the efficiency of their apparatus was well illustrated in the dynamo machine, which was claimed to have a capacity to generate sixty arc lights, each of an intensity of 2,000 candles. Instead of sixty lights, this dynamo furnished energy for sixty-four lights of 2,000 candle-power, with an absorption of forty-four horse-power.

The commutator of the Brush dynamo, as exhibited, is peculiar and original. Each terminal wire from each pair of coils pierces the shaft of the machine, which is hollow, and runs out to a separate plate of the commutator. In order to secure greater space for the brushes, but four wires run to each commutator, and the plates are so arranged that the brushes are constantly on two of these. As the power of one pair of coils runs down another is introduced into the circuit, and as this occurs with each of the commutators in the machine with twelve



THE BRUSH-SWAN EXHIBIT AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

coils, the number of coils in circuit varies from eight to ten, according to the position of the coil before the poles of the magnet. By simply altering the position of the brushes so as to throw the coils in the circuit a little before their greatest efficiency is reached the quantity of the current may be reduced and the power necessary to produce it correspondingly lessened. The currents from the corresponding brushes on the separate commutators are united in the general circuit, and the resulting current is thus remarkable for its steadiness and freedom from sudden alterations.

In the Brush electric arc lamp, as exhibited, the magnet is wound differentially, and its armature raises the upper carbon when the quantity of the current is great, and allows it to fall when the intensity overcomes the quantity. The armature is attached to the edge of a ring, which loosely surrounds the upper carbon. When this armature rises it first cants the ring, and so takes hold of the carbon. Its further rise raises the carbon with it. The intensity magnet is wound with a branch wire from the main circuit, and when the arc becomes long it overcomes the attractions of the quantity magnet and the armature falls, releasing the carbon, which then drops on the larger carbon.

The principal feature of the Brush-Swan exhibit was, of course, the storage batteries. Each contained twenty-one cells, one battery being established in the exhibit on the main floor, and the other in the gallery, near the press room. Affixed to the wall, near the latter, was the ingeniously-contrived "manipulator," so called, by which the Brush Company regulates the current going to and coming from their storage batteries. It is automatic and self-acting, and hence, like all other apparatus of the Brush type, intended for household use, requires no technical supervision whatever. In the upper corner, on the right hand side of the manipulator, running down obliquely toward the center of the apparatus, is the circuit for the changing current. From a clamp in juxtaposition with a magnet, it continues along a wire leading upward and passing to the rear of a horizontal wire to a thicker and heavier wire magnet, and returns again to the clamp in the center of the box. From here it descends to a clamp, clasping a perpendicularly placed carbon pencil. There are five dials in the upper part of the apparatus, placed side by side. The hands of these indicate in hours, and parts of hours, just what period the charging current has passed through the battery. A little mechanism for the purpose of controlling the clockwork is affixed to a well-poised lever. When the circuit is complete a small wire bearing against the escapement-wheel of the clock apparatus is raised with the lever, the wire is freed from the balance-wheel and the clockwork is enabled to perform its office of recording the time of the passage of the current. But as soon as the lever, being acted upon, falls down again, the wire passes once more across the balance-wheel and stops any further movement.

Each of these Brush batteries exhibited show the possession of an electromotive force of close upon 38 volts while in action, and readily furnish the electric energy for fourteen incandescent lamps, each having an intensity equal to the power of sixteen candles. Taken as a whole, one of these batteries has a capacity of about 240 hours, furnishing sufficient current meantime to keep up the maximum intensity of the lamps. After this work is performed it must be charged again from the wire leading from the central station.

At one side of the Brush Company's headquarters was exhibited the ring armature of the Brush dynamo; and further along, in an inclosed space, the Brush electro-plating machine, which now has attained fame in two continents. This electro-plating machine corresponds in general to the arc machine, as designed by Brush, except that the field magnets are coarsely wound in general circuit, in order that the electromotive force may be at the low degree required for the class of work it is designed to accomplish. The electro-plating machine was exhibited in operation, and, naturally enough, attracted much attention. It was driven by a Brush motor, and, to those who had seen the old-style battery apparatus in operation, proved a revelation. In fact, it is this type of machine that has made nickel-plating practicable.

One of the best recommendations this machine could have was unconsciously furnished by a large plating company, which, desirous of exhibiting the excellence of their plated wares, exhibited the process in practical operation, in which they used the Brush electro-plater, having, as they said, found this the most reliable and efficient, after trying all the other descriptions of electro-plating machines. Specimens of very superior nickel-plating were nightly distributed among the spectators of the process itself. These electro-platers have been found to produce from a given expenditure of power the maximum amount of electricity. The largest portion of the electricity so produced is available for external work—the plating being performed in the baths—and the minimum is absorbed in the machine itself. The result is that the machine does not become hot when doing its maximum amount of work. Moreover, this machine does not, as many others do, require water to cool it, and is so arranged that it is impossible for its poles to reverse while running, which is a great advantage. The adjustability of the brushes at the commutator prevents its wear by an undue amount of spark, and its parts are made interchangeable, so that in case of accident they can be quickly replaced. The manner of connecting up the currents from the armature is novel, and prevents pulsation of current.

Another part of the Brush-Swan exhibit was devoted to illustrating the manner employed by the company to light up steamships, a description of work in which this company may fairly be said to have excelled, since many of the finest steamships afloat are lighted from stem to stern with the Brush-Swan system.

On most of the great fleet which is lighted by means of the Brush-Swan apparatus, both arc and incandescent lights are used. Nor does the stoppage of the marine engines affect these lights. On the contrary, they are arranged to be generated by auxiliary engines in no way connected with the ship's engines. The lights have proved so efficient on shipboard that each of the new passenger steamships, before leaving the shipyard, is fitted with them throughout. Thus do the passengers escape the bad light, the smell, and, above all, the dangers which are begotten of using illuminating oil upon the high seas.

Smith's Electric Tramway.

In regard to electricity as a motive-power, we are able almost weekly to chronicle some additional application of electrical energy to the work of rail and tramways, small launches, hoists, printing presses, and well nigh a thousand other mechanical appliances. Owing, doubtless, to this fact, many instances might be given of electricity being used with complete success in the place of horse-power for tramways, and it has been shown almost conclusively that of the three it is the safest, most economical, and certainly most sightly. One of the best systems brought forward with this end in view is, without doubt, that invented by Mr. Holroyd Smith (of the firm of Messrs. Smith & Baker, Cornbrook Telegraph Works), at whose invitation select parties of gentlemen, interested in engineering generally, were recently enabled to judge for themselves of the efficiency and capabilities of such a method of propulsion. These trials took place on Friday and Saturday last, and, as before, on a short length of ordinary tram line laid down in a field at a little distance from the works, and, aided by favorable weather, they proved a complete success. The car itself, and the general arrangements by which the system is carried out, have been already illustrated and described; we may, however, with advantage briefly recapitulate the principal details. The necessary current is generated from a dynamo machine in the works, and is carried by means of stout cables to and from the field in which the line is laid. From the terminus it flows along the two halves of a split copper tube, sunk in the ground between the rails, is picked up therefrom by means of rollers mounted on a small carriage, transferred thence to the motor (which by suitable gearing causes the car wheels to rotate), and finally returns to its starting place by means of the two outer rails. When fixed, therefore, in the streets ready for use, all that would be visible to the passer-by consists of the usual grooved iron rails sunk in the stone setts, and midway between them a third iron rail split vertically in two, with an interstice of about half an inch.

Through this slight groove is brought a connection between the small carriage running in the halved copper tube and the motor upon the car, avoiding thereby any possible short circuit of the current by some luckless cab horse or mischievous street urchin.

The whole system, in short, is exactly analogous in principle to the well-known Halliday cable tramways, in which an endless wire rope, running continuously along a narrow channel, sunk in the street, is gripped at will by a connection from the tram car.

The advantages claimed by Mr. Smith as being due to his system are numerous and important. There is primarily, as we have said, complete immunity from shocks or short circuits, all the positive connections being laid below the street level out of harm's way.

There is the enormous gain in weight as compared with accumulators when used in a similar capacity; skilled labor is reduced to a minimum amount, whilst the care and trouble of constantly charging and recharging storage batteries is completely avoided.

Speed is a question of choice; the motion of the car is perfectly easy and uniform, and it can be stopped in a space of ten yards whilst running at the rate of twelve miles per hour.

It is but fair, however, that we should draw attention to some points which seem to us to need careful study in view of alteration and improvement. In the first place, the narrow slit or groove in the center rail will, we imagine, prove a somewhat fruitful source of trouble by the accumulation of rubbish or impediments, in spite of the self-cleaning nature of the contact carriage.

A second item worthy of consideration is the comparatively high resistance of the iron rails used as a return, and the inventor might possibly find it advantageous and economical to fix a thin copper strip along the inside of the rail to avoid the loss that is probably incurred by the current passing along the iron, which is of higher resistance, though larger sectional area. Care would also need to be taken with regard to the mechanical arrangements necessary at crossings and junctions if such a system were carried into practice, though doubtless there is sufficient ingenuity in the world to provide for all emergencies of this nature, as well as for the proper drainage of the channel sunk in the street between the rails.—*Mechanical World.*

Electric Light in the Cotton Fields.

The appearance of the cotton worm in certain districts of the South during the past—we should say the current—summer, brings up afresh the question as to the best and most effectual means of checking its ravages. Professor Riley has rendered the cotton interest a vast service through the medium of his investigations. He has analyzed the character and habits of the caterpillar; shown us the secrets of its different evolutions and pointed out the vulnerable places at which to make the attack. Yet Professor Riley has taught us one thing more clearly than any other in the connection; which is, that the worm in its butterfly stage is most accessible and most readily destroyed. It is true that the worm succumbs to Paris green, but it is not so easy to reach when clinging to the under side of a leaf, nor is the machinery for the distribution and application of the poison as convenient and economical as could be desired. Our farmers have been struggling with the antiquated apparatus and cumbrous appliances known to their experience, and there is no doubt they have often saved their crops against desperate odds. But the struggle is a weary one, and it would be a boon to the entire cotton growing industry if some more accurate and expeditious means of accomplishing the same end could be devised.

A way seems to be open, however, in a new direction. Its efficacy is promised with reasonably definite emphasis, because if pine-knot flambeaux are used to destroy millions of the butterflies, why should not the electric arc light, which is so much more brilliant and conspicuous, destroy other and more numerous millions? We have seen the merit of the electric light as a bug killer very fairly tested here in New Orleans. We have seen that the light attracts insects to a degree hitherto unknown, and that it possesses mysterious and enormous powers of extermination. The trouble has been to dispose of the dead. When the globes were first placed upon the levee they used to get filled with the charred corpses of pinch-bugs, roaches, mosquitoes, and a hundred varieties of grotesque and repulsive specimens of insect life. It became necessary to inclose the open space above the globes so as to prevent bugs from getting inside. Even then, they were slain in myriads every night, so that the ground for many feet around the post was black with them.

Now, if the electric arc will work all this havoc, even when inclosed, upon such tough and hardy reptiles as we see lying dead every night beneath the lamps, what would be the effect of an open electric arc in a cotton-field during the butterfly season? The butterfly, or miller, is helplessly fascinated by a brilliant radiance; it is a delicate creature of very slight vitality. The electric arc, on the other hand, exerts prodigious attractive force and possesses a wholesale power of destruction which simply cannot be described. It strikes us that this is a suggestive grouping and conjunction of conditions which our farmers might very profitably take under consideration. The electric light seems to offer the most practicable and economical solution of the cotton-worm problem.

Electrical Transmission of Power.

The important experiments on the transmission of power by electricity, which have been for a long time in preparation, between Paris and Creil, will enter shortly upon a practical phase. It will be remembered that a powerful syndicate was formed some time since to realize on a large scale the theories of M. Marcel Deprez upon the electrical transmission of force, which theories received a practical development at the Palais de l'Industrie in 1881, at Munich, on the Northern Railway of France, and at Grenoble. This syndicate, composed, among others, of the Paris house of Rothschild, the Creuzot and Fives Lille companies, and the Societe Industrielle et Commercialle des Metaux, subscribed a capital of half a million francs. The new series of experiments will be conducted between Paris and Creil. The programme has been prepared by a commission consisting of M. Marcel Deprez; M. Sartiaux, director of the Northern Railway of France; M. Aron, engineer to MM. de Rothschild; M. Cael, director at the Ministry of Posts and Telegraphs, and several other distinguished engineers. The late M. Ch. Bontemps was also a member of the commission. According to this programme, it is intended to furnish at the Creil Railway Station an initial motive-power furnished by two locomotives, each of 130 horse-power. These two engines will together drive the generating dynamo through four totalizing dynamometers, of a new type, by which it will be easy to read continuously the work transferred to the dynamo.

The generating dynamo will give a current of 20 amperes, with an electromotive force of 7,500 volts, corresponding to about 200 horse-power absorbed. This energy will be transmitted to two smaller dynamos placed at the La Chapelle Station, in Paris, and which, it is expected, will develop 50 per cent. of the initial energy, one giving 60 and the other 40 horse-power, which will be employed to drive a number of machines for mechanical purposes and for electric lighting.

The dynamos were constructed by the Fives-Lille Company, and some idea of their dimensions may be given by the fact that 17,600 lbs. of copper wire has been used in winding the armature and field magnets. The transmission line, which is more than 70 miles long, and includes a complete circuit, will be laid overhead, and will consist of a cable with seven strands of silicious bronze, made by M. Lazare Weiler, of Angouleme. These strands have a diameter of 1.9 millimeters, and together correspond to a single wire of five millimeters in diameter. The weight of the line will be from 2 to 2½ tons, and its total electric resistance is less than 100 ohms. Its breaking strength exceeds 1,900 lbs. From the initiation of the experiments the question of employing an insulated or non-insulated cable was warmly discussed. The necessity of insulation appeared at first to be of the greatest importance on account of the high tension of the current, and which it was intended to raise to 10,000 volts. Under these conditions, the engineers of the commission representing the State wished to inclose the cable in a protective insulation to prevent loss of current, especially during rain, and to avoid accidents. After a number of experiments, it was decided to abandon continuous insulation, which would have the twofold inconvenience of great expense and imperfect protection. It was considered that accidents were little to be feared, since it would be a complete circuit fixed on high posts above the reach of ordinary interference, and a mixed system was decided on, which involved the insulation of about 47 miles of the line. This insulation, which was executed by the Societe Generale des Telephones, is on the Berthoud-Borel system, by which the wires are inclosed in a lead envelop. Experiments with this arrangement have given quite satisfactory results, though it was found that with a current of 2,500 volts the cable thus covered acted like a Leyden jar, the envelope giving off static sparks during a considerable period. The inconvenience from this would be easily overcome by connecting the lead to earth; or by breaking the lead envelope at intervals, and especially at the junctions, 500 yards apart, and making good the joints with hard rubber, the total surface of the condenser would be reduced, and the effects entirely prevented.

It is expected that all the preliminaries of the trials will be completed in a month or two, and that they will be carried out at the end of the year.—*Engineering.*

The World's Fair at New Orleans.

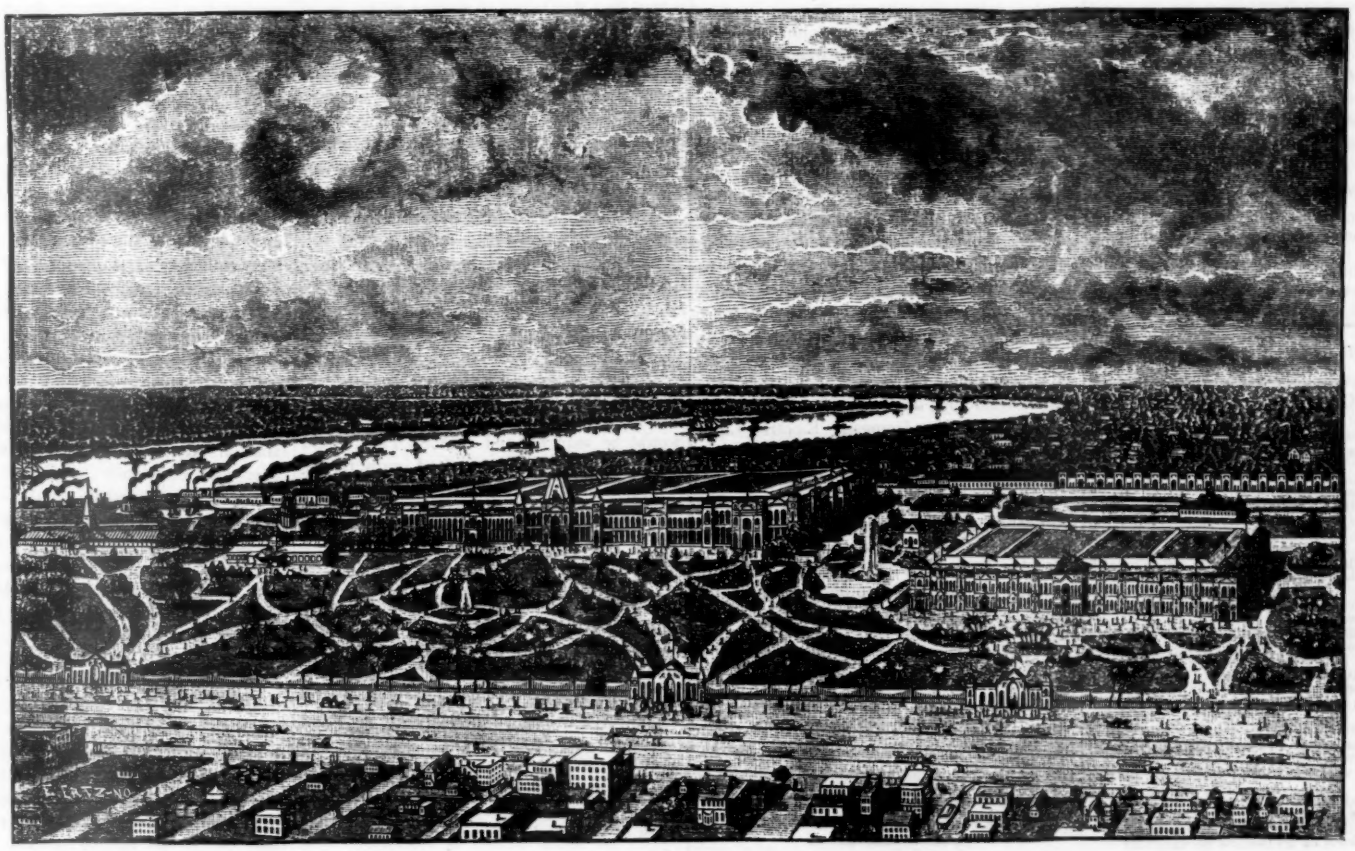
As many of our readers are greatly interested, we give in the accompanying illustration another graphic view of the splendid site of the World's Industrial and Cotton Centennial Exposition at New Orleans, La. The City Park, whereon the exposition is erected, is a convenient, level tract of land, containing 249 acres. Only that part of the park containing the largest exposition buildings is shown in this view. Beyond the park is seen Carrollton, now within the city limits. The green forests on the opposite bank of the great river, stretching away in the dim distance, add much to the beauty of the scene. The chief natural feature is, of course, the Father of Waters—the Mississippi River. Numerous steamboats may be seen descending the river, laden with the rich products of our broad country, gathered along 17,000 miles of navigable streams of water. This mighty river is capable of affording a harbor for the largest ocean vessels, the deepest soundings in front of the city being 200 feet.

In the foreground are seen the arched gates to the park, newly erected hotels, street cars, carriages, and promenaders, the whole forming a map of busy life.

Entering a gate, one sees so much that he hardly knows how or where to begin a systematic tour of inspection, threading his way along the tasteful walks adorned by shrubs and flowering plants, he passes through the grand entrance of the main building that is here figured in the center of the picture. The interior of this building is grand and imposing. Within, the aspect is bewildering, owing to the extraordinary size of the structure. The visitor finds here a great room of enormous size, having thirty-three acres of floor space and without partitions. The great Music Hall, 800 feet long, in the center of the building, having accommodations for 11,000 persons, has no side walls, the roof thereof resting on a number of great arches. The machinery section, 1,378x300 feet, is also under the roof of the Main Building. The Music Hall and Machinery Hall occupy apparently but a small part of this enormous building, the largest in the world. Great sections are allotted to the exhibits of foreign nations. Here may be seen ranged side by side the displays of Turkey, Asia Minor, China, Siam, Japan, Germany, Belgium, Russia, Austria, and Hungary, Portugal, Spain, Italy, France, Great Britain, Denmark, Sweden and Norway, Mexico, and the Republics of South America. A great and grand spectacle, truly. Nor is this all. Along the floor surrounding the foreign exhibits are the no less interesting products of the United States ranged in groups for the convenience of visitors.

From the wide gallery that extends around the inside of the building one may witness a sight that has never had its equal elsewhere. The great civilized nations have here arrayed their curious products, and invited the attention and scrutiny of the world. Many other things beside the displays will attract the attention of strangers. The chime of bells, the great organ of the Music Hall, telegraph station, fire department, administration offices, electric lights, restaurants, refrigerators, newly devised elevators, and the thousand and one appliances necessary to conduct and control the greatest of all great World's Fairs.

Through the center of the building runs a line of railway connecting with all the trunk lines on this continent.



SOUTHERN VIEW OF THE WORLD'S FAIR BUILDINGS AT NEW ORLEANS.

M. Jablochkoff's New Battery.

For a considerable time M. Jablochkoff has been engaged in studying a new battery. Although it is not yet possible to form a definite judgment as to its value, it is interesting to know its principle.

An element of this battery is formed as follows: M. Jablochkoff takes a small rod of sodium, weighing about 8 grms. This rod is flattened so as to form a plate about 0.15 meter long, 0.02 wide, and 0.006 meter thick. At one end there is made a slit, into which is introduced a small tongue of amalgamated copper upon which the sodium is tightened, so as to form a good contact; this little plate serves to receive the current. On the other hand there is a small plate of carbon, about 0.20 meter in length and 0.02 in breadth. This carbon is not such as is used for arc lights nor for batteries. It is an agglomerate like them, but it ought to be very porous and light. This plate of carbon is perforated with three small holes, into which are put small wooden pegs. The sodium plate is then wrapped in a band of silk paper; it is laid upon the carbon plate and pressed in such a manner that the wooden pegs may penetrate into the soft metal and fix it upon the carbon. For greater security the whole is tied together by means of a few turns of fine iron wire, taking care that it does not form an electric contact between the sodium and the carbon. The element is thus complete, the carbon and the small leaf of copper fixed in the sodium form the electrodes.

This battery acts, says a writer in *La Lumiere Electrique*, in virtue of the affinity of the sodium for oxygen. This metal, on exposure to the air, becomes oxydized, forming caustic soda, which condenses the moisture of the air, dissolves and drains gradually away in a concentrated solution, thus exposing the surface of the metal, which then continues the reaction.

The electric conditions of this couple have been measured at Breguet's establishment. Its electromotive force is = 2.5 volts, its current = 0.1 ampere, which gives an internal resistance of 25 ohms. The weight of the element is in all about 50 grammes, and its price is lower than it might seem at first sight. M. Jablochkoff thinks that on the large scale sodium might be obtained at a very low figure. At present it may be had at 10 francs per kilo.

A small element thus constructed is not to be considered as the unit of the battery. M. Jablochkoff proposes to group ten of them in quantity; for this purpose the rods of carbon are traversed by two holes in their entire length. Through these holes is passed an iron wire, terminating in a ring. By means of these rings the small elements are suspended upon rods of wood supporting a copper packing, which forms the necessary communication for associating them by tens in quantity. The group thus formed gives an ampere on short circuit.

These groups are then associated either in series or quantity, like the elements of ordinary batteries. It is convenient to keep them suspended so that the solution of caustic soda which is formed may readily flow off.

Such a battery acts as long as the air is moist. The only means to stop its action is to shut it up in an air-tight case

According to M. Jablochkoff, the battery, when arranged can act for 24 hours in a sufficiently regular manner, if it is placed in an atmosphere that does not vary. The electromotive force depends on the degree of moisture, on the temperature, and on the ambient air. The inventor considers that this circumstance gives an advantageous means for regulating the action of the battery.

—— The Austrian Minister of Justice has had experiments made with the electric light in the prisons of the Empire. If the light gives the results which are confidently expected it will be adopted for the new prisons in course of construction at Prague and Marbourg.

Electrical Review.

Published Weekly at 23 Park Row.

P. O. BOX 3329.

GEO. WORTHINGTON, }
WM. A. HOVEY, } - - - Editors.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

ADVERTISING.

$75.00 per inch per annum.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of ELECTRICAL REVIEW P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania.

Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, NOVEMBER 15, 1884.

CONTENTS.

	PAGE
The Brush-Swan Exhibit at the International Electrical Exposition	1
Smith's Electric Tramway	2
Electric Light in the Cotton Fields	2
Electrical Transmission of Power	2
The World's Fair at New Orleans	3
M. Jablochkoff's New Battery	3
Editorial Notes	4
Notes from the Northwest	4
Platinum and Platinum Wire	5
Incandescent Lighting on a Providence Railroad Car	5
Drawbaugh Telephone Controversy	5
Telephonic News	6
Texas Telephonic and Telegraphic Talk	6
The Microphone	6
Arguments by Representatives of Telegraph, Telephone and Electric Light Companies Against the Enforcement of the Ordinance Requiring the Removal of Poles and Wires	6
Telegraphic	7
Electrical and Scientific	8
On a New Electromotor Depending on the Oxydation of Carbon in the Cold	8
On the Disruptive Discharge of the Holtz Machine	8
Clark's Standard Cell	8
Phonography as a Study	8
On the Distribution of the Potential in a Liquid Mass of the Form of an Infinite Rectangular Prism	8
Description of a Column with an Automatic Arrangement for Renewing the Liquid	8
Electric Lighting Considered from a Sanitary Point of View	9
Electric Light News	9
New Electrical Patents	10

The General telegraph office at Berlin has been lighted for some time past with 17 arc lights, which replaced 112 gas burners. The luminous intensity of the electric lamps at an angle of 30 degrees is equal to 1,400 candles, and the 164 Morse instruments and 48 Hughes instruments which are in use in the office are lighted in a most satisfactory manner, and without shadows, by the skillful disposition of the lights.

A contemporary, who has long fought against the introduction of the electric light, in its last edition says: "The brilliant and powerful arc light is fast superseding gas for the illumination of streets and large buildings, but for the office, the reading room and the dwelling the incandescent light seems destined to take precedence, as it affords a clear, steady and brilliant light, without the flicker of the arc, and is entirely noiseless. The facts that it can be placed as readily as a gas-burner, takes no more space, is as easily handled, and cannot communicate fire to a contiguous object, are also strong points in its favor."

Among the many wonderful things exhibited at the World's Exposition at New Orleans will be an "electro mechanical signaling apparatus," which gives promise of making railway travel in future a trifle safer than staying at home. This wonderful contrivance not only gives warning of such ordinary dangers as the approach of "wild" trains, obstacles upon the track, or broken bridges or trestles, but if the draw of a bridge is ever so little out of place it rings a bell in the engine cab and another at the house of or post of the bridge keeper. If a trestle or culvert is out of line in any direction so as to create a danger, or if a tunnel wall sags in a threatning way, a faithful little hand points out the danger upon a dial, and the bell in the cab rings sharply, waking the engineer if asleep, and calling his attention to the signal.

While the exhibits of the Mechanics' fair are being removed from the Massachusetts Charitable Mechanic Association building, the work for the electrical exhibition is being rapidly pushed forward. Many of the out of-town exhibitors have arrived, and are preparing their displays, new applications are coming in daily, and the display of electrical novelties promises to be quite extensive. Among the arc light systems that will be shown in Boston for the first time is the Arago system of the White House mills, New York. Their radial disk dynamos took one of the three gold medals given for dynamo machines at the London Electrical Exhibition, where they run 128 Swan incandescent lamps, lighting up part of the art gallery. At the Boston exhibition they will, however, run the new McCarty arc lamp, and will therewith illuminate the tower, as well as part of the upper floors in the building. Their machine is a shunt machine, entirely self-regulating, can run from one lamp to the full maximum of the apparatus, without change of speed or brushes, the power reducing itself to the number of lamps run. The Domestic Electric Light and Power Company, which is lighting a car on the Providence railroad by Trouve batteries now, will also make a display at the exhibition. Beside their apparatus for domestic lighting, they will show boats, tricycles, lathes, sewing machines, etc., run by their motor, and a number of portable lamps, the light of which is generated by a battery located in the base of the lamp. But one of the greatest novelties to be displayed is an electric water meter. This will be attached to a pipe in the building and be shown in operation. It is worked by a magnet, and is said to be absolutely accurate, measuring from the smallest quantity to that consumed by a whole city, and will also detect any waste or brekage.

We are glad to learn that the Baltimore and Ohio's copper lines between this city and Chicago are working admirably, and giving such superior service that more lines are to be put up at once There is a saving in the number of poles, in their size, in transportation charges, in labor, and a steadiness in conductivity, especially in wet weather, which iron cannot give. All indications point to the great increase in the use of copper in the future.

The Brush Electric Company was given leave about a year ago to light up Delaware Avenue, in Philadelphia, with their light. They gave the Callendar Company, of London, the contract to lay their patent cable 18 inches under the pavement, which was done, putting the cable in a bed of four inches of sand. The lights worked well for a short time, but then they commenced to get weaker night after night, until now they won't work at all, having developed into a complete failure. So much for this underground system has been said that we are surprised at the results obtained in such a short period. We intend to investigate the merits of this system, and several others who have been advertising very loudly recently, and show them up for just what they are worth once more, as it is time the public were enlightened in regard to some of these underground conduit schemes.

EDITORIAL NOTES FROM THE NORTHWEST.

Besides the Brush Company, the United States people are doing something here in Minneapolis and St. Paul. In the latter city they have a small arc light plant of about 15 lights, run from a Wright engine. The power is hired. They also run the Weston incandescent system from the same station, but as yet its proportions are small. They have an incandescent isolated plant in the Opera House, which works very satisfactorily. In Minneapolis they have started a station for incandescent lighting in the vicinity of the big Washburn Mill, run by water power. Here they have two 200 light machines, and are lighting the mill named and several others. It is their intention to extend the system throughout the city, and they claim that they can compete with gas and make money.

In St. Paul the gas people early came to the conclusion that the way to fight the devil was with fire, and so they started a Fuller plant on their own hook. They are doing the bulk of the lighting in the city, and are doing it reasonably well. My idea is that they don't care to show a particularly good electric light, and I think they are meeting with very fair success in their endeavors.

Just here let me say that there is much complaint about the telephone service in St. Paul, which, subscribers say, does not compare with that in Minneapolis. The main reason is that in the latter city they have the multiple board, while in the former they are still using the old Western Electric Standard, a very good board for small exchanges, but, by the same token, a very poor one for large exchanges. If a new multiple board could be put into Minneapolis, the one now there transferred to St. Paul, and the St. Paul board divided up for use in the smaller exchanges, I think the improvement in service would be marked, and that St. Paul would gain two or three hundred subscribers There is no sufficient reason, outside of the character of the service rendered, why it should not have as many subscribers as its rival.

Minneapolis has a very excellent and well managed district telegraph system which has some peculiar features that deserve comment. It does a general parcel, package, and trunk delivery business, keeping several wagons constantly employed. This began in a small way by employing boys to carry bundles. The business men in the retail line found them very useful in the delivery of purchases to customers, and at length the work became so large in volume that the use of teams was necessary. Another feature is the mounted messenger service, which is very popular. Like all Western cities, Minneapolis is a city of magnificent distances, but everything is done with a rush, and a slow going messenger boy, such as one sees in New York, would never answer. So they put some of the boys on ponies, charge double price for their time, and find demand enough for their services I noticed one improvement in the call boxes here, due to the ingenuity of Mr. Palmer, the present manager of the telephone company here It was found that the carelessness of people having boxes in their house often resulted in their pushing the indicator away over to the word "Fire," when they only wanted a messenger, and this caused so many false alarms that it made the Fire Department tired, and all out of conceit of the District Telegraph Company as a source of reliable information. Mr. Palmer has invented and patented a very simple stop, so that the indicator cannot be pushed over to "fire" unless pains are taken to first depress a certain button. The result is that, since the application of this improvement there have been no more false alarms, and the Fire Department is happy again.

Minneapolis has the automatic fire-alarm system and a paid department, which is in very efficient condition. It has just put in the Gamewell Police Telegraph system, with call boxes and telephones, and has established seventeen stations of the sentry-box persuasion, at which the police are made to report hourly. There is a patrol wagon service in connection with this, and the whole police system has come to depend exclusively on electricity as a means of inter-communication.

St. Paul is a repeating station of the Western Union and has a well-equipped office. Minneapolis is less fortunate. Its office is small, and things have a depressing and gone-to seed look. "Economy" is the word, and it is practiced with a vengeance. People here tell me that, although business is lively with the company here, the service is by no means what it should be, and might be. Rates are high, there being no competition. Now what the Western Union really needs here is a wide-awake competitor, one that would force it to have a decent office and give good service for a reasonable price. In these days 75 cts. for ten words to New York is *not* reasonable. The Bankers and Merchants built a line up here, but they couldn't pay the contractor, and so the Western Union took it in. There is a fine opening for the Baltimore & Ohio up this way, and I am sure that the people would welcome them. It would also be a good thing for the Western Union, but of course they can't see in. Their business office in Minneapolis is in every way uninviting, dirty, shabby and disgraceful to them, and the sooner they move into better quarters, or at least clean up the ones they are now in, the better it will be for them. A good scrubbing and a dollar's worth of paint would improve it fifty per cent.

There never was a better chance for an electrical railway than between these two cities. There are good transportation facilities between them, trains running half-hourly, on the hours on one road, and on the half hours on the other. But the two cities are destined to grow towards each other, and, eventually, as all seem to believe, they will grow together. This is probably a sanguine view, considering that they are ten miles apart, but it is very certain that the intervening space is to be in the nature of a great suburb, belonging alike to both cities. Now, an electric railway running on a direct line from city to city is just the thing wanted. A narrow gauge steam road would do, but it has its objections. The distance is too great to make a horse railroad profitable, and a "grip" road is hardly the thing But an electric railway, taking power from the Falls of St. Anthony, would be just the thing, and would rapidly build up the country between the two cities. The road should be double tracked, with the conductors in a conduit such as is used on the "grip" or "cable" roads, and the trains should be kept running constantly. It might not pay heavily at first, but in time it would be very profitable, and a "big thing" for the two cities and their inhabitants. There is talk of an elevated road, but what need there is of putting a road on stilts when land is so plenty, I fail to see. The owners of property between here and St. Paul ought to be not only willing, but glad, to *give* the land for a direct electrical road connecting the two cities. The increase in the value of the remaining land would compensate them over and over again.

There is no "underground wire" foolishness in this country. The people realize the benefit that electricity brings to them, and they are not fools enough to "kick" because its use necessitates the erection of poles and wires. There are no house-top structures, everything being on poles, and these in the main, are good in quality, and well and substantially put up. They are in nobody's way, they injure nobody, and they are the means of protection, information, light, and, indirectly, of profit to everyone. To take them down would be to bring on a stroke of commercial and social paralysis, and any man that suggested it would be hooted out of town. Folks here have no use for a man who cannot see that the advantages which

electricity brings outweigh the disadvantages of poles and overhead wires, and have no time to either educate him or listen to them. You might as well tell them that they ought never to have built great mills along the Mississippi river because they had thereby disfigured the landscape and robbed the Falls of St. Anthony of their native beauty.

Platinum and Platinum Wire.

The principal portion (about, in fact, all) of this material, for which the demand is always greater than the supply, comes from the famous mines of the Demidoff family, who have the monopoly of the production in Russia. It is all refined and made into sheets of various thicknesses, and into wire of certain commercial sizes before it comes to us; but we have frequently to cut, roll, and redraw it to new forms and sizes to meet the demands upon us. At one time it was coined in Russia, but it is no longer applied to that use. We have obtained some very good crude platinum ore from South America, and have refined it successfully, but the supply from that source is, as yet, very small. It has also been very limitedly found in Colombia, but the explorations thus far made into the mineral resources of South America have been very meager, and it is by no means improbable that platinum may yet be discovcovered there in quantities rivaling the supply of Russia. A popular error respecting platinum is that its intrinsic value is the same as that of gold. At one time it did approximate to gold in value, but never quite reached it, and it is now worth only $8 to $12 an oz., according to the work expended upon it in getting it into required forms and the amount of alloy it contains. The alloy used for it is iridium, which hardens it, and the more iridium it contains the more difficult it is to work, and, consequently, the more expensive. When pure, platinum is as soft as silver, but by the addition of iridium it becomes the hardest of metals. The great difficulty in manipulating platinum is its excessive resistance to heat. A temperature that will make steel run like water and melt down fire-clay, has absolutely no effect upon it. You may put a piece of platinum wire no thicker than human hair into a blast furnace where ingots of steel are melting down all around it, and the bit of wire will come out as absolutely unchanged as if it had been in an ice box all the time. No means have been discovered for accurately determining the melting temperature of platinum, but it must be enormous. And yet if you put a bit of lead into the crucible with the platinum, both metals will melt down together at the low temperature that fuses the lead, and if you try to melt lead in a platinum crucible you will find that as soon as the lead melts, the platinum with which it comes in contact also melts, and your crucible is destroyed.

A distinguishing characteristic of platinum is its extreme ductility. A wire can be made from it finer than from any other metal. The gauge of the sample I now show is only one two-thousandth of an inch, and it is practicable to make it thinner. It has even been affirmed that platinum wire has been made so fine as to be invisible to the naked eye. The draw-plates, by means of which these fine wires are made, are sapphires and rubies. One can fancy how extremely delicate must be the work of making holes of such exceeding smallness to accurately gauge, too, in those very hard stones. We get all our draw plates from an old Swiss lady in New York, who makes them herself to order. But, delicate as is the work of boring the holes, there is something still more delicate in the processes that produce such fine wire as this. That something is the filing of a long point on the wire to enable the poking of the end of it through the draw-plate so that it can be caught by the nippers. Imagine yourself filing a long, tapering point on the end of a wire only one eighteen-hundredth of an inch in diameter in order to get it through a draw-plate that will bring it down to one two-thousandth. This very fine wire is used in surgical operation, and also in telescopes. A newly invented instrument has been described, which, if it does what has been affirmed, is one of the greatest and most wonderful discoveries of modern science. A very thin platinum wire loop, brought to incandescence by the current from a battery—which, though of great power, is so small that it hangs from the lapel of the operator's coat—is used, instead of the knife, for excisions and certain amputations. It sears as it cuts, prevents the loss of blood, and is absolutely painless—which is the most astonishing thing about it. It is stated that a large tumor was cut from a child in this way, and that the child laughed while the operation was being performed, and that without any anæthestic being administered. Our greatest consumers of platinum are the electricians, particularly the incandescent light companies. The quantities of wire required by the Edison and the maxim companies so constantly increases that the demand threatens to exceed the supply of the metal.

Incandescent Lighting on a Providence Railroad Car.

On Wednesday evening, car No. 71 on the 5.05 o'clock P. M. Dedham train, *via* Hyde Park, was lighted by 12 incandescent electric lamps of about 12 candle-power each. These lights were supplied by batteries which are carried in one end of the car, and produced an illumination of the car in every way satisfactory to the passengers, and far superior to that furnished by the best oil lamps used on railroads.

There are four batteries of six cells each in the group used in this car, and the incandescent lamps used are what are known as the Woodhouse & Rawson lamps. The battery used is known as the Trouve, and is in fact a bi-chromate battery of peculiar construction. It consists of a wooden trough in which are fitted from four to six ebonite cells, each containing one zinc and two carbon elements. The elements are connected by means of movable clamps, and are attached to a windlhss by which they are raised from or lowered into the exciting solution, as required to regulate the intensity of the current. A wooden stop, which may be pushed aside when necessary, prevents the elements from being entirely raised from the cell, while the height of the crank, allows of the cells being removed for emptying and refilling. A spindle covered with india rubber supports the elements, the zincs being notched at the top to facilitate their fixation or removal, thus enabling them to be reamalgamated and rapidly rearranged. The car using incandescent lights produced by the Trouve battery makes several trips to and from Dedham every evening.

M. Trouve, the inventor of this battery, is a Frenchman, and is the inventor of various electrical appliances. He has made a battery to carry on the person, by which ballet effects are produced upon the stage. This battery can be utilized by means of a small lens fastened upon the forehead, from which the light is projected by a reflector inside, and is used by surgeons in uterine and rectal examinations, and by otologists. He has also invented numerous jewelry and other electric light effects to be worn upon the person, as well as medical batteries, etc., but his principal invention, outside the one for producing light, is his motor. This is a very small affair in comparison with the power which can be developed through it, and can be used to run sewing machines, dental lathes, church organs, for pumping water, propelling tricycles, boats, etc., etc. It is said that this motor will soon be applied to horse car propulsion in Providence.

The company controlling the Trouve inventions in this country—the Domestic Electric Light and Power Company of Boston—do not claim that by the use of the battery in question it can produce light as cheaply as it can be furnished by gas in Boston, but it does claim, that when gas sells at $2 per 1,000 feet, it can furnish an equal illumination by electric incandcescence for the same money. The experiment on the Boston & Providence railroad will be viewed with interest by all who see that the tendency in light, as well as power, in the future is inclining toward electricity as the form or medium best adapted to our wants in these respects. The company is now having made portable electric lamps, in which the battery furnishing the light will be located in the base. These and other things of a kindred nature show that we are only on the eve of great achievements in electricity.

Do we, in our application of power, says an exchange, make as much use of wind, water and waves as we ought, remembering that their power may be transmitted to a distance? Do we resort, to any large extent, to sources of power in nature other than coal? Is it not the fact that mechanical invention has gone back in these matters rather than forward? And do we utilize that primary source of power, the heat of the sun, the current heat from year to year, making the most of barren hillsides, as it seems to me we might do, by planting quick growing trees, which, fostered and matured by the sun, would yield large quantities of wood to be used as fuel for domestic purposes? Are we estimating at their full value the deposit of peat, and are we not tempted to pass by this large store of fuel because its use is attended with difficulties? Is it not true that we use coal in the most grossly wasteful manner? How much of the fuel goes up the chimneys of our furnaces unconsumed, in the form of invisible carbonic oxide?

In spite of the greatest possible care, many of the pieces that are prepared for coins are either too light or too heavy. The first are remelted and the others are filed away until they have the proper weight. These operations cause the loss of valuable material, and interfere with the sharpness of the impression. W. F Chandler Roberts, chemist of the London Mint, employed an electric current in connection with suitable acid baths, in order to regulate the solution of superfluous metal, having ascertained that the quantity dissolved was exactly proportioned to the time, if the current was kept constant He also provided, in a similar way, for the galvanic deposit of additional metal upon coins which were too light. In both methods, provision was made for automatically breaking the circuit, when the right weight was reached. These processes can not be applied at the London Mint, where the law directs that every defective piece, whether too heavy or too light, shall be remelted. They have, however, been used with great advantage at the mints of Bombay and Calcutta.

The points at which the potential differences are to be measured are connected with the two coatings of a condenser with intercalation of a Deprez and D'Arsonval galvanometer (a wire coil suspended from silver wires between two magnetic poles), and the first deflection is read off by means of a mirror. The condenser may have different capacities, according to the magnitude of the potential difference and the degree of accuracy required. The conductive wires must be very thin, not coated over, and well insulated, in order that their capacity may be neglected.—*Wi dermann's Beiblatter.*

If mercury in a glass is covered over with water slightly acidulated, into which is plunged an aluminium wire, and if the mercury and the wire are connected with the negative pole of a battery of two Daniells, whilst a platinum plate immersed in the water is connected with the positive pole, the surfaces of the wire and of the mercury are deoxidized by the hydrogen gas evolved. If the wire is then plunged down into the mercury it becomes moistened, which did not take place previously, and is amalgamated. On exposure to the air the surface becomes dull, flocks of alumina appear and separate from the wire. Iron may be amalgamated in the same manner, and in time the mercury rises up along the immersed wire.

.... Communication with America through the new Mackay-Bennett cables has now ceased entirely. It is believed at the London office that the damage has been caused by icebergs off the banks of Newfoundland. It is hoped here that the cable officials of New York will be able to communicate soon with the Faraday, and that repairs will be proceeded with forthwith.

Editors Electrical Review:

In your issue of September 27th, 1884, on page 5, I see a note from your correspondent at the Philadelphia Exhibition referring to a papier mache insulator, and I wish to correct him in some points mentioned in his item.

First, my insulator is not papier mache, but is pressed from paper pulp. Second, it is not *saturated* with asphalt, but is impregnated clear through with asphalt and oil Third, it is not moulded but pressed under a pressure of 12 tons. Fourth, glass machinery cannot be used in its manufacture as it is pressed *cold*. Fifth, we claim dirt will lodge on the surface, as it is perfectly smooth and the oil it contains gives it the best water shedding surface in the world. Sixth, the insulator is finished under 285 degrees of heat, consequently no sure heat can possibly affect its surface. Seventh, the surface cannot become disintegrated, as the surface and body are precisely alike perfectly impregnated with asphalt and boiled oil, it stands a strain of 900 pounds, and a crushing weight of over 1,000 pounds. We have had them in use nearly two years with good success. Hoping you will publish my letter and correct the gentleman's statement or opinion, I remain yours respectfuly,

C. C. HINSDALE, Patentee.

The Drawbaugh Telephone Controversy.

We think that no intelligent and candid person, after carefully reading through the eight thick volumes of evidence and exhibits, comprising nearly 6,500 octavo pages, which have been taken within the past four years by the United States Court, in order to determine whether Alexander Graham Bell or Daniel Drawbaugh was the first inventor of the speaking telephone, can help being impressed with the truth of two propositions: First, that the claimant, Drawbaugh, and the 366 witnesses who testified in his behalf have utterly failed to make out a case which can by any conceivable possibility prove to be sufficient to overthrow the Bell patent; and, second, that the whole case indicates the existence of one of the most extraordinary and widespread conspiracies for the purpose of destroying a patent which has ever occupied the attention of a court of justice in this or any other country.

The whole case lies in a nutshell. To defeat a well-established patent on the ground of prior knowledge and use, it must be established beyond the possibility of a doubt that some other person had invented and actually constructed an operative apparatus and had applied it to some useful purpose within the knowledge of the public. To this eminently sound rule of law there has never been, so far as we are aware, a single exception. In the present case the defendants have produced a single pair of operative magneto-telephones only, which they claim to have been made by Drawbaugh before the date of the Bell patent, but he himself refuses to state under oath when these were made, or whether or not they were made before the date of the Bell patent.

Among his vast array of witnesses, only *two* could be found willing to swear to having heard speech through these instruments before the summer of 1876. The deposition of one of these witnesses conclusively shows that the alleged occurrence took place after the summer of 1876, and the deposition of the other proved that any statement he might make must necessarily be utterly unworthy of belief.

We have but little doubt that these facts alone, to say nothing of the corroborative evidence, are quite sufficient to control the decision, and hence we are convinced that the judgment of the Court cannot well be otherwise than in favor of Bell We publish elsewhere a detailed analysis of some of the more important features of the case. It will repay careful reading by all who are interested in the final result of this most unprecedented legal controversy.—*Electrician and Electrical Engineer.*

Telephonic News

*** It is announced that the executive committee of the Societe Generale des Telephones will soon publish a reduction of five per cent. in the price of subscription for periods over three years. The number of its subscribers is now 5 417 for all of its central office systems.

*** The German Telegraph Administration intends to put the city of Leipsic in direct telephonic communication with Dresden and Chemnitz, so as to allow the subscribers in these cities to speak, as well as the general public, through the central telephone offices opened in these three cities.

*** During the month of September 15,004 telegrams have been exchanged, by telephone, between the subscribers to the telephone concessions, and the telegraph offices connected therewith, viz: 3,342 at Brussels; 2,904 at Liege; 2,841 at Antwerp; 2,345 at Ghent; 1,691 at Charleroi; 985 at Louvain, and 956 at Verviers.

*** The New England Telephone and Telegraph Company has tendered a reception to its operators Saturday evening, Nov. 15, from 8 to 12 o'clock, to be held at the new operating rooms 50 Pearl Street, Boston. This will bring together a large number of the lady operators on the "trunk lines," who are daily conversing with each other, but who who have never met, and will bring about a better acquaintance.

*** We learn that a definite agreement has been made between the State and the Compagnie Belge du Telephone Bell, for the exploitation by the latter company of telephonic communication between cities. While awaiting the time when the public can be admitted to profit by the advantages of this arrangement, certain privileged persons have been authorized, within a few days, to establish communication between Brussels and Antwerp, and it appears that conversation is quite easy in both directions.—*La Lumiere Electrique.*

*** In the latter part of 1881 the Postal Telegraph authorities of New Zealand introduced the telephone into the colony, and with success, as the number of subscribers at the following exchanges shows: Dunedin, 300: Auckland, 250; Christchurch, 186; Wellington, 220; Invercargill, 40. "Bureau," a public call office, has been opened, and is much appreciated. The fact that no special skill is required on the part of the person in charge of a telephone, as in the case of a telegraph operator, has led to a large proportion of the country post offices being connected, settlers in sparsely populated districts thus having the means of communicating with other parts of the colony to an extent they would not otherwise have possessed. In order to encourage private residence connections, the exchanges have recently been kept open all night.

*** The New England Telephone Company is making important changes in its quarters on Pearl Street, as well as in the appararus used for "central" business. A new system, called the "multiple," will be used, all lines will be permanently connected with each operator's table, so that when any subscriber calls for a number his wire can be connected by the operator with whom he is conversing, and if the line wanted is in use that fact can be discovered immediaiely by each operator and can be immediately communicated to the subscriber. With the new switches, also, an operator can tend to 100 lines much easier and with more despatch than he now can handle 50.

In the new quarters into which the central office will be removed in a week or two there will be facilities for 4,700 lines, there being only 2,000 lines now. New subscribers may be connected much more easily by the underground cables which are now working well. A new feature will be the running of cables in the air. By them wires which now take up almost 100 square feet will be so compressed that 100 wires will require about an inch only. This will obviate much of the objection to overhead wires, and also protect them from storms and other dangers.

Texas.

TELEPHONIC AND TELEGRAPHIC TALK.

The REVIEW for October 25th has gone its rounds in our big commonwealth, and, if the article under caption, "Quarreling Among Themselves," doesn't cause smiles to caper over the countenances of the noble army of telephone men, they are not up to my expectation in their appreciation of a laughable farce. We have many illustrations of "pot calling kettle black" in this Senegambian neighborhood, but none more spirited than that. The Pan-Electric Company have roped in a few innocents in Texas. One of our well-known and respected public men is numbered among its victims. He is too smart to stay there long; mark it. Men of his capacity and acuteness can find a way of escaping from masked batteries, even after being entrapped.

By the way, speaking of infringements, how did the electrical papers come to overlook Messrs. Fisher, Clarke and Bates, examiners-in-chief of the Patent Office, in the case of Voelker *vs.* Gray *et al.*? I find in an Ohio paper, dated October 25th, a consolidated report on it, and, as it is of vital interest to telephone people, I will endeavor still further to condense it here. It was a patent interference case involving the invention of the speaking telephone. There were eleven cases. The examiner of interferences had awarded priority of invention to Bell in seven cases, to Edison in two cases, and McDonough in one case. Case G was, however, the one upon which the real and final issue depended, as it practically covered the telephone invention—the receiver. This case, it appears, the examiner of interferences had awarded to McDonough. But the examiners-in-chief arrived at a different decision. They declared that the point upon which the case hung was that as to whether Bell's record dates could be overcome. "After an exhaustive review of a great mass of evidence upon this point," the examiners say, "upon the whole, McDonough's proofs cannot be held to be sufficient to overcome Bell's record dates." A party contesting the right of a patentee must show a completed and perfected apparatus. That McDonough did not have. Had a patent been granted him, as described in his application, or as experimented with in July, 1876, the public would have been no wiser than before. In this respect, McDonough gave no more to the world than Reiss, of whom it was said by Justice Lowell: "A century of McDonough would never have produced the speaking telephone."

Now, the above is all news to me, if it isn't to the REVIEW, and I take the liberty of inserting it herein, for the benefit of my Texas contemporaries. It's more than likely that your next number, however, will have advertised the whole matter. Now, let Judge Wallace step to the front. We Texans are probably not so eager for, nor anxious about, the matter as our Eastern brethren of the lightning; but, of course, we are interested in the great squabble, and want all the information that's going. You are giving it us in unmeasured heaps, even from Buffalo. It isn't the George Worthington himself who is doing the grand tour, is it? If so, and he slights Texas, he will miss a great opportunity to meet the great Connoly, inventor of the now quiescent but future great current amplifier, the renowned telegraphist, journalist and modest inventor, which would alone be worth twice the cost of admission. He can be seen in Texas only. It is the sole stall in which there is room for his giant qualifications to develop their fullest capacity. His newspaper—the *Texas Rail and Wire*—is a bright little sheet, which contains a Simon pure, true-enough telegraph-operator story of the deepest dye, presumably written by the genial Mike himself. Every railroad telegraph operator ought to have it. If there is any virtue or precious acuteness that the hero lacks, it is some abstract or obtuse quality unknown to Connoly. Mr. Worthington, himself a telegraph man of yore, should miss no opportunity to investigate such an old-timer as Mike, especially if he is traveling about in search of electrical information for scientific minds.

If there is anything he (Mr. W.) doesn't know about electric lights, Mr. Hipp, of Galveston, will take pleasure, I am sure, in acting as informant.

Notwithstanding the latter's short excursion into the Hopkins telephone field, he is still an authority upon his best subject, and he don't forget it.

Tho Galveston plant is probably the best in the State, which statement, in view of the fact that Raphael, of Houston, is still in the field, with a fine outfit, is not to be considered a weak one. But Hipp takes the lead with a large number of lights. Both gentlemen have secured contracts for lighting the streets of their respective cities, and their lights do shine upon the dark ways at a tall profit per annum.

The telegraph fellows are not worked so hard that they could not spare a minute or two to a welcome guest this season. Cotton is short and business is dull, and Jerry Newton, the experienced manager at San Antonio, or Ben. Pillow, the oldest in Texas, at Austin, or even the dignified Felton, of Houston, might throw off for a brief period their heavy responsibilities, and talk "old times" with an officer of other days. And the telephone fellows, too, find business more dull than usual at this season, and, I presume, Ladd, the former sailor of the high seas, present manager at San Antonio, could escape from his many applicants and his blooded fowls for a time sufficient to shake hands with a REVIEW man.

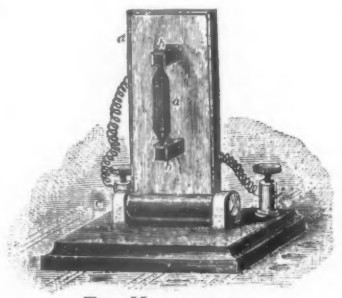
Linn Ladd is a pleasant fellow to know, and Tom Milburn, the division superintendent, who can outwalk any two linemen in the State, has an office in the same interesting old Texas town, and its worth more than a journey from New York to Texas to hear him pun. Reed, at Dallas, is an agreeable gentleman, and he, together with Tower, of Dennison, the only young Bostonian, coming in with the Erie, who had grit enough to stick, and Bostick, of Fort Worth, McMurray, of Paris, Cunningham, of Long View, or Marshall, and oh, ever so many others of the host, would lay aside complaints and crosses, breaks and grounds and other terrors, for a smile with your representative. Notice that I refrain from putting inverted commas and a hilarious construction upon the word "smile." We never do in Texas. I have also refrained from prophesying what would happen to Mr. Worthington should he visit Austin, and fall into the hands of the Erie's divisional executive force—Dunbar, Carruthers and Will Pillow. It would have to be seen to be appreciated. G. W. F.

Galveston, Texas, Nov. 10th, 1884.

The Microphone.

BY PROF. E. J. HOUSTON.

The microphone is a contrivance for magnifying the intensity or loudness of sound. By its means an observer is enabled to detect faint sounds, such as the walking of a fly, or a whisper, at a distance of many hundreds of miles.



THE MICROPHONE.

The microphone is, in reality, a form of telephone transmitter. It belongs to the class of transmitters that varies the resistance of an electric current.

The operation of telephone transmitters of this class may be explained as follows, viz.: Suppose a circular plate of elastic metal, such as is used in the telephone receiving instrument, to be supported at its edges so as to be able to vibrate freely, and to be provided with a conical conducting point, securely attached by electrical conducting material to the center of the diaphragm. If, now, the diaphragm and its conical projection be connected with one terminal of a battery circuit, and the other terminal be connected with a vessel of mercury into which the free end of the projection dips, speech uttered against the diaphragm can be distinctly heard in a telephone receiver placed in the circuit of the battery and the transmitting instrument.

The manner of operation is as follows: The current that flows through the circuit of the battery is dependent on the resistance of the circuit: if this resistance increases, the current decreases; if the resistance decreases, the current increases.

If, now, the receiving diaphragm be so adjusted that the point dips but slightly beneath the mercury surface, the effect of the sound waves striking against the diaphragm will be to cause it to vibrate, and consequently, to vary the depth that the point dips below the mercury surface. The further the point dips below the surface, the smaller the resistance of the battery current, and the greater the current that passes through the receiving telephone. The to-and-fro movements of the transmitting diaphragm are consequently followed by similar movements of the receiving diaphragm.

The form generally given to the microphone is shown in the figure. It consists of a small pencil of carbon *a*, pointed at both ends and supported in cavities of two carbons, *b*, *b*, that form the terminals, *c*, *c*, of an electric circuit. The supporting carbons, *b*, *b*, are rigidly attached to a thin elastic board *d*, suitably supported at its lower end.

If, now, a telephone be placed in circuit with the microphone, any disturbance of the supports of the carbons, capable of producing movements in the vertical carbon, will cause variations in the current of electricity that flows through the telephone.

A very great variety of sounds is heard when a person listens at the receiver of a telephone placed in the circuit of a microphone. For example, a fly walking across the supports of the board that holds the carbons produces a sound that has been likened to the tramping of a horse. A watch placed on a table near the microphone can be distinctly heard to tick. A person talking in a low tone of voice is distinctly heard by a listener at the telephone.

The explanation that has been given as to the working of the microphone does not appear to be entirely satisfactory. That most generally received, however, appears to explain nearly all the phenomena, and is as follows, viz.: If the waves produced by the voice of a speaker strike against the elastic board that supports the movable carbon, variations will be produced in the amount of surface of the vertical carbon *a* that touches the cavities in the supports, *b*, *b*, and there will thus be introduced into the electric circuit variations in the amount of electric current that flows, and, consequently, variations in the strength of the magnetism in the telephone receiver.

These variations in the current strength produce corresponding movements in the plate of the receiving telephone, and consequently reproduce sounds resembling those causing the disturbance.

The microphone has been put to a variety of uses. In the form shown in the figure it is too sensitive to act well as a transmitter of the human voice. It can, however, carry musical sounds very well, and, if delicately adjusted, can be made to transmit speech.

Nearly all forms of telephone transmitters are, in reality, variations of the microphone. —*Primer of Electricity.*

Arguments by Representatives of Telegraph, Telephone and Electric Light Companies Against the Enforcement of the Ordinance Requiring the Removal of Poles and Wires.

A meeting of the Electrical Committee of Councils was held in Select Council Chamber at Philadelphia last week.

A large number of gentlemen, representing different "corporations, firms and individuals operating and maintaining telegraph, telephone and electric light poles, wires and fix-

tures on, over and across the streets of the city of Philadelphia," were present.

The communication from Chief Walker relative to the ordinances requiring him to exact license charges from the different companies, and also to notify them to remove all overground poles and wires, was read.

Colonel Banes said the matter had been referred to the City Solicitor to draft an ordinance to meet the inconsistencies of the existing ordinances, and a new ordinance from that official, entitled "An ordinance to provide for the removal of all poles and wires for telegraph, telephone and electric light purposes, and for the placing of all such wires underground," was read. It provided as follows:

Whereas: By an ordinance of the Select and Common Councils of the city of Philadelphia, approved June 13, 1882, it was provided that all poles and wires erected for telegraph, telephone and electric light purposes, by firms, corporations or persons, other than the city of Philadelphia, should be removed from the streets of the city of Philadelphia prior to the 1st day of January, 1885; and that it should be unlawful, after that date, to erect or maintain any such poles and wires; and that any corporation, or person, or persons, excepting the city of Philadelphia, violating the provisions of said ordinance, should forfeit $50 for every day each of said poles was maintained; therefore,

Section 1. The Select and Common Councils of the city of Philadelphia do ordain that before the first day of January, 1885, all firms, corporations and persons maintaining poles and wires for telegraph, telephone and electric light purposes other than the city of Philadelphia, shall remove the same.

Section 2. That the City Solicitor upon the failure of any such firm, corporation or persons to remove such wires and poles, is hereby instructed to take legal proceedings to enforce the provisions of the ordinance of June 13th, 1882.

Section 3. That on and after the 1st day of Jannary, 1885, all wires for telegraph, telephone and electric light purposes shall be placed uuder ground.

THE CITY SOLICITOR'S OPINION.

The opinion of the City Solicitor, which was called for at the last meeting of the Committee, was then read as follows:

"I have your communication of October 30th, enclosing a resolution adopted by the Electrical Committee, requesting my opinion as to whether there are any legal obstacles in the charters of the American District Telegraph and Philadelphia Local Telegraph, or other companies, which would prevent the city from enforcing the ordinance requiring the removal of poles, wires and fixtures from the streets of the city prior to the first Monday of January, 1885.

"In reply thereto I have to say that in my opinion the regulation of the manner in which the streets shall be occupied by telegraph companies, in the exercise of their franchises, with reference to public rights and the well-being of the State in the premises, is within what is known as the police power. This power cannot be bartered away, either by the State Legislature, or its agent, the municipality. The constitution, article xvi., section 3, provides that 'the exercise of the police power of the State shall never be abridged or so construed as to permit corporations to conduct their business in such maner as to infringe the equal rights of individuals or the general well-being of the State.'

"No charter right can be maintained that is in conflict with the police power of the State, which is reasonable and exercised by the State or its proper agent.

CITING CASES FORMERLY DECIDED.

"In the case of the Southwark Railroad Company vs. The City, 11 Wright. 321, it is said: 'Subject to the paramount authority of the Commonwealth, the regulation and control of the streets, which are the great highways of the State, belong to the city government.

"In the case of Branson vs. The City, 11 Wright, 332, it is said: 'In respect to the care, regulation and control of the highways' the city exercises a portion of the powers of the State, subject only to the end in view—the right of the public to their use as public highways.'

"These cases are cited by Thayer, J., in the case of the City of Philadelphia vs. The Western Union Telegraph Company, 2 W. N. C. 455, in which it is held that the ordinance of April 18, 1863, Digest of Ordinances, 558, forbidding the erection of poles without the consent and authority of Councils, is a lawful and reasonable police regulation, and binding upon telegraph companies, empowered by legislation to run their lines through the city.

"I am, therefore, of the opinion that there are no legal obstacles in the charters of the American District Telegraph and Philadelphia Local Telegraph, or other companies, which would prevent the city from enforcing the ordinance of June 13, 1882, requiring the removal of poles, wires and fixtures from the streets of the city prior to the first Monday of January, 1885."

STATEMENTS FOR THE COMPANIES.

Representatives of companies having overhead privileges were then heard in response to the invitation of the Chairman.

Henry Bentley, President of the Bell Telephone Company of Philadelphia, and on behalf of the Philadelphia Local Telegraph Company, made an address against the enforcement of the ordinance. "We have not been able," said he, "to see any way by which we could put our wires under ground with any degree of success. We have tried in many ways to obtain some method that would give satisfaction, but without avail."

Speaking of the business of the Telephone Company, Mr. Bentley said that to force their wires under ground at this time would be ruinous. The people, he said, could not be accommodated, and the business of the concern would be brought to a standstill. He referred to the underground system in London, and asserted it should not be taken as a reason for the enforcement of the ordinance. He declared positively that there were more wires or branches inside of buildings in Philadelphia than there were outside and under ground in the whole city of London. Mr. Priest, an Englishman, had said to him, "We know nothing of the telephone; we are but children in the science."

THREE THOUSAND MILES OF WIRE.

There are 3,000 miles of telephone wire in the city of Philadelphia, he added, and the Company is just as anxious as Councils to place them under ground. Any practical suggestion from any responsible person looking to this end, he said, would be gladly accepted and tried by the Company.

Referring to the local system of telegraphy, Mr. Bentley pictured the "luxury and comfort" it afforded the people The pushing of a button in one's house to bring immediately a messenger, a policeman or a fire extinguisher, he said, was a thing unknown to London or other European cities. English scientists, he said, had admitted it, and an eminent Frenchman, on witnessing the systems, and especially that of the telephone, had said, as if it was beyond the grasp of the ordinary citizen, that "in my country a Rothschild might do that."

Mr. Bentley then referred to the Bankers' and Merchants' system of delivering stock and other quotations. The ramifications of these systems, he said, extended to every man's house, to his office, to the club, to the commercial and other exchanges, and connected distant cities as if by magic.

Europe, he said, had nothing like it. The few systems they had were no comparison to ours.

To force the wires under ground, when no system of working them there successfully was known, he said would simply destroy the business of the companies, deprive the city of the revenue it derived, and her people of their vast conveniences.

Their expeditious communication, he said, would also be shut off.

Mr. Gross, of the committee, inquired of Mr. Bentley the length of time he had been experimenting on the underground system.

Mr. Bentley replied that the different schemes which were put forward had been tested from time to time for two years past. He said the subject of underground wires had been with the company day and night, and no stone had been left unturned to hit upon some feasible method of running the wires under ground in cables. The efforts, however, had failed.

William J. Latta, general agent of the Pennsylvania Railroad Company, stated that that company had an underground cable system of its own, running from Broad and Filbert streets to Fourth and Walnut streets. There were 150 wires on the cable, but only a few of them were telephone wires. There were about 100 telephonic connections, however, and these seemed to give better satisfaction under ground than otherwise. The system had been in operation he said about six months.

CLAIMS OF THE WESTERN UNION.

A communication from George L. Crawford and Benjamin Harris Brewster, representing the Western Union Telegraph Company, was next presented. It set out that the company had received notice from the electrical department to place its wires under ground; that for a long time past it had been spending money in experiments to obtain a reliable underground system, but had not succeeded. To force the companies to accept the imperfect underground systems of different parties, it was said, would be injudicious, and the removal of the aerial wires unsafe to the public service. The company would gladly put its wires under ground, it was said, if any practical system were known.

General manager Gill, of the Western Union Company, stated that experiments had been going on in New York for a long time past but that the experience attained would not warrant a removal of the aerial wires at this time. Three wires had been put under ground by the Brooks system in this city, he said, but a cable could not be made to work.

Mr. Hamilton, of the Western Union Company in New York, stated that the Brooks underground cable had been laid in New York, but that it did not work properly. The longest distance it had been laid, he said, was about two miles.

It was then stated that the Western Union Company owned a majority of the stock of the Brooks Company.

CONCERNING ELECTRIC LIGHTS.

Secretary DeCamp of the Brush Electric Light Company, stated that the difficulties which Mr. Bentley had spoken of were also experienced by his company. They could get no cable, he said, to work under ground. The company was willing to put its light to the test.

Samuel Dickson, on behalf of the Brush Company, referred to a suit now pending against that company at the relation of the Attorney General, in which the commonwealth sought to have the poles and wires removed, upon the ground that they were a public nuisance. About 1000 pages of testimony had been taken, he said, and the weight of the expert testimony clearly showed that the carrying of wires under ground was not feasible. There were no lights of any consequence in Europe, he said, and it was not only a matter of national pride, but of commercial interest and public convenience, that the systems should be maintained.

DECLARED IMPOSSIBLE.

George I. McKelway, on the part of the Maxim Company, which was said to be one and the same with the United States Electric Light Company, stated that he coincided with the remarks of Messrs. DeCamp and Dickson. He declared that it was "absolutely impossible to place the wires under ground so far as was known at this time." He said the company would be pleased to have its wires under ground if that were possible.

On the part of the Baltimore and Ohio Telegraph Company, manager Dillon, of Philadelphia, stated that that company intended to put its wires under ground. The company had started recently, he said, and, as yet, had made no experiments.

Mr. Harrison, of Harrison Brothers & Company, stated that that firm desired to put its wires under ground by the Brooks system, but that it could not get the privilege from Councils. They were prepared and willing, he said, to go ahead with the experiment.

Samuel B. Huey, on the part of the American Bell Telephone Company, stated that the company's expense list on experiments for underground systems amounted to nearly $100,000. If the company in this city, he said, could only get their wires under ground they would save large sums of money which they now expended for roof privileges and in other ways.

Representatives from other companies were also heard, but their statements were very much the same as those already mentioned.

TELEGRAPHIC

.... The Director of Telegraphs of the Canadian Government will soon leave Ottawa for British Columbia, to hasten the construction of a new telegraphic system which will be built parallel with and at the same rate as the construction of the Canadian Pacific Railroad.

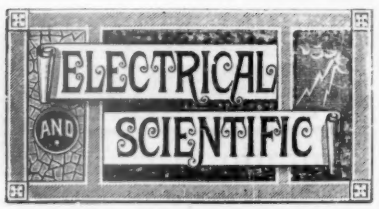
... Mr. Otway, one of the sub-directors of the central telegraph office in London, has been appointed Director of Telegraphs at Cairo. It is to be hoped that the new director will give satisfaction to the numerous complaints to which the bad administration of this department has given rise, in Egypt, as well as in England.

.... The New York end of the Bennett-Mackey ocean cable is being hung on hooks under the Brooklyn Bridge. It is 3,400 feet long, and weighs 45,000 pounds. The various companies that hang their wires across the gigantic structure pay about $8,700 for the privilege per year, and the cable companies' share of this is $250.

.... Telegrams can now be deposited in the postal letter-boxes throughout Germany. They must be endorsed "Telegram," and be prepaid for the amount of the tariff in postage stamps attached, or else the tariff is collected from the addressee. We see no particular advantage in this innovation, which is not calculated to augment the rapidity of transmission of despatches.

.... The telegraphic conference, which will meet next year at St. Petersburg, will probably discuss a new tariff for the transmission of despatches on submarine cables; it is believed that the cable companies will especially endeavor to reduce the limit of code words from ten to eight letters, which will, in the opinion of experts, be equal to an increase of 25 per cent. in the actual cost of telegrams.—*La Lumiere Electrique.*

.... Western Australia is engaged in constructing a line of telegraph along about 700 miles of its coast line, from Northampton to Roebourne, the object being twofold, viz: first to establish speedy means of communication with the settlements near Roebourne; and secondly, to induce an English company to run a cable to North West Cape from Java. The first and most difficult section, from Northampton to Hamlyn Pool, a distance of 140 miles, has just been completed; of this, for 115 miles, the line runs over heavy sand plains and hills, and as, unfortunately, it had to be constructed in the summer, it has proved a trying task for man and beast. Mr. Carey has been intrusted by the Government with the charge of this most important work. His staff consists of Mr. Parish (overseer), and a light survey party, with which he keeps in advance, pegging out the route for the line, himself returning from time to time to inspect the line, while Mr. Parish, the Government overseer, is closely watching the construction on behalf of the Government to see that the specifications are carried out. The transport consists of 20 horses, two wagons and wagonette, and 30 camels, recently purchased in South Australia at the suggestion of Mr. Kean. With the camels there are five Afghan drivers thoroughly broken into this work. A ketch of about 70 tons follows the party along the coast, laying poles, stores, and water at all available landing-places. The working party consists of white men and Chinamen, 15 in all. The poles used on this line are iron; they are in two sections; the short section is 4 ft. 6 in. long, and is supposed to be driven into the ground where practicable, or, if the ground is too hard, inserted in a hole bored by an auger. The use of the auger, however, was found to be a slow and tedious process and was abandoned for the spade in both hard and soft ground. The socket once in, the long section is lifted up and dropped into the socket, cement being then poured in to bind them together.



* * According to Edwin Alden & Bros., (Cincinnati, O.) American Newspaper Catalogue for 1884, there are 14,867 newspapers and magazines in the United States and the British Provinces. Total in the United States, 14,176; in the British Provinces, 691: divided as follows: Dailies, 1,357; triweeklies, 17; semi-weeklies, 168; Sundays, 295; weeklies, 10,975; bi-weeklies, 39; monthlies, 1,502; bi-monthlies, 26; quarterlies, 83; showing an increase over the publications of 1883 of 1,594. The greatest increase has been among the weekly newspapers of a political character, while it has been least among class publications.

* * Dr. Aron has exhibited, at the meeting of the Berlin Electrical Society, various specimens of vegetable carbon, which were made conductors and rendered almost incombustible by energetic and prolonged heating in a vacuum or in a neutral atmosphere. These properties are so much like those of graphite, that the product may well be called artificial graphite, although it is not crystalline. The experiment shows that if, as has been affirmed, the presence of hydrogen in graphite determines its combustibility, this can be true only of combined hydrogen, for carbon which has been calcined and made incandescent in an atmosphere of hydrogen is no more combustible than before.

* * The Liverpool and Manchester line of the London & Northwestern Company, in the district where the passenger railway had its birth, has utilized electricity for lighting the carriages by means of "glow" or incandescent lamps of twenty candle-power each. The engine for working the dynamo-electric machine is on the tender behind the locomotive, and is supplied with steam from the boiler of the locomotive. The electric current passes from the generator through the train and then back to its source, where, fixed to the foot-plate, is a regulator fitted with an electric lamp showing the engineer the degree of light in the train. Each compartment in the train is provided with two glow lamps so arranged that if one of them is extinguished the other is lighted instantly.

* * Herr Uppenborn, of the *Centralblatt fur Elektrotechnik*, has investigated the rules to be followed in making the wires which serve for the conductors of dynamo-electric machines. With regard to their insulation, he advises a double covering of cotton threads, coated outside with spirit varnish. The special object of the insulating substance is to prevent contact between the wires. The cotton covering should not, therefore, be thicker than is strictly necessary for preventing an exposure of the metal when the wire is bent. This is secured by adopting the following thicknesses of cotton covering for the respective diameters of wire: 1 mm. and under of wire, 0.5 mm. of covering, 2 and 3 mm. (0.6 mm.), 4 mm. (0.7 mm.), 5 mm. (0.8 mm.), 6 and 7 mm. (0.9 mm.), 8 mm. (1 mm.), 9 and 10 mm. (1.1 mm.).

* * Simultaneous experiments with cable railroads operated by steam power and electrical railroads, naturally suggested to many inventors a combination of the two systems. The central underground tube is made to carry a fixed electrical conductor instead of a moving wire rope, and connection is made between the motor and the conductor through the slit in the tube. An electric railway on this principle has been built for experimental purposes at Manchester, England, and is said to work satisfactorially, even in rainy weather. The improved contact due to moisture is supposed to make up for the loss by leakage. In this system the running rails of the road are used as return conductors. Leather straps are used to draw the connector through the tube. They serve to clear the passage way of ordinary obstructions, and if they should meet with too much resistance, would give way, breaking the connection and stopping the car before much damage was done. These straps can be easily and cheaply replaced.

* * Dr. Dobell lately advised that noxious germs should be destroyed by passing an electric current through the water that contains them. A similar idea appears to have occurred to Dr. Stephen Emmens, who has devised an electric filter, consisting of a glass vessel, in which are placed porous vases. These latter contain coal or spongy iron, and also carbon plates connected with the positive pole of a Leclanche battery, being kept apart by other carbon plates communicating with the negative pole. The water to be filtered flows into the porous vases, passes through the coal or spongy iron, and runs out of the containing vessel. Like Dr. Dobell, Dr. Emmens supposes that the oxygen set free destroys all the germs which might render water injurious to health. The invention is also applicable to the purification of sewage waters, in which case the filter takes the form of a conduit, divided by partitions into a series of elements, traversed in succession by the water. The electrodes are wooden cages, alternately filled with pieces of iron and coke. With this arrangement a primary battery is not necessary, for the conduit itself forms a powerful battery, the current of which is more than sufficient.

* * Carbons for arc lights are formed by thoroughly incorporating a mixture of finely divided carbonaceous materials, such as the purer forms of coke, or gas retort carbon with some liquid substance, such as oil, tar, or sugar syrup, that, when subjected to a high temperature, is capable of being carbonized. The finely-divided ingredients are thoroughly mixed and made into a stiff paste with the carbonizable liquid, and then forced by heavy hydraulic pressure through circular apertures in plates. The continuous cylindrical rods thus obtained are cut into suitable lengths, carefully dried, and then heated to incandescence in ovens while out of contact with air. By this process the carbonizable liquids are reduced to a carbon which thoroughly binds together the various ingredients. Experience has shown that the higher the temperature and the greater the length of time during which the carbons are subjected to the baking process, the greater their hardness and the higher their electrical conductivity. In order to insure freedom from slight porosity, in most cases the carbons are subjected to a rebaking. After removal from the oven, they are soaked in strong syrup, and again placed in the oven and heated to incandescence as before.

On a New Electromotor Depending on the Oxidation of Carbon in the Cold.

By A. Bartoli and G. Papasogli.

The electromotive force of retort coke as against gold or platinum in potash or soda-lye is equal to 0.06 up to 0.17 D., that of Ceylonese graphite rather lower; in solutions of the carbonates of potash or soda 0.10 –0.17 D.; in hypochlorite of soda, which does not attack retort coke directly, but only in the closed circuit, at temperatures between 14—100° C., 0.18—0.27 D., on returning to 14° C. it is 0.18° D. again. The same holds good with Ceylonese graphite. Other carbons conduct badly, and are attacked by the hyperchlorates (hypochlorites?). If mixed with equal parts of Ceylon graphite and moulked into cylinders with asphalt they have, in solutions of hypochlorites of potash or soda, the electromotive force of 0.1—0.2 D.—*Gazetta Chimica Italiana.*

On the Disruptive Discharge of the Holtz Machine.

When we employ a Holtz machine in which the exciter is so constructed that the spark may be taken at will on the right or left of the axis of the apparatus, we find that the position given to the movable part of this exciter is far from being unimportant.

Thus, if we leave this complete with its collectors and condenser; if, moreover, we place the two movable arms in such a position that the positive collector is nearer to its condenser than is the other; in short, if we destroy the symmetry by breaking the circuit from the positive side, we obtain, with a moderate distance, two straight feathers of unequal length, the longest corresponding to the positive pole. These feathers do not join, but produce deep detonations. I will call them detonating feathers.

If, without altering the rest of the machine, we change the side of the opening so that the positive conductor will be the longest, the case is completely changed; it will be no longer possible, whatever be the distance between the collectors, to obtain detonating feathers; the ordinary spark is always produced.

Again we may demonstrate the influence of want of symmetry by raising the collector of the positive pole. If then the interception is on the positive side, we can obtain a very broad and very long double feather. If, on the contrary, the interruption is on the side of the negative pole, the feather attains at most one half the length. If we raise the collector of the negative pole, the influence of symmetry is not manifested.

We may repeat these experiments after having raised the condensers; the phenomena are generally the same as in the previous case, but much less intense.

Moreover, the importance of the question of symmetry is not only proved by optical phenomena. Mechanical effects lead to the same conclusions. In fact, if, after having deprived the exciter of its collectors, we suspend between the points a strip of paper 0.10 m. long and 0.2 m. wide, making the opening on the positive-pole side, the paper is energetically repelled by the negative pole; if, on the contrary, the interruption is on the side with the negative pole, the repulsion is caused by the positive pole. This experiment succeeds with or without condensers, but the result is much clearer when they are not used.

It is worthy of remark that, if the branches of the exciter are placed symmetrically in relation to the axis of the machine, repulsion is produced with the positive pole with Leyden jars; by the negative pole when these are not employed.

In writing the preceding, I have confined myself to the simple statement of facts, without attempting to prejudice any theory. It seems to me that the cause of the phenomena observed should be regarded as a reciprocal induction of the various parts of the machine.—*Comptus Rendus.*

Clark's Standard Cell.

Dr. C. R. Alder Wright has been studying the peculiarities of this standard of electromotive force. When made in the best way, and Mr. Clark's instructions rigidly followed, the electro-motive force in different cells lies between 99.65 and 100.35, representing a variation of ±0.2 per cent. from the normal value of 100. Provided the cell is sealed up with paraffine, this value will continue steady for months or even years. No current must, however, be passed through it in a reverse direction and the cell must not be worked, otherwise it may become permanently deteriorated. The electromotive force does not appear to be affected by the presence of dissolved air in the solutions, so that boiling the mercurous-sulphate paste in setting up the cell is wholly unnecessary; but, on the other hand, Dr. Wright finds that the strength of the zinc sulphate solution has a great influence on the electro-motive force, the effect being to increase the E.M.F. by an amount roughly proportional to the deficiency from saturation, and rising to over 2 per cent., or more than .03 volts with weak solutions. All the measurements of E.M.F were made with a Thomson reflecting quadrant electro-meter. The coefficient of variation of E.M.F. with temperature was carefully determined between the limits of about 0 deg, and 25 deg. C., and found to be 0.00041 on the average of ten fairly concordant values with different cells, so that the E. M. F. of a Clark's cell at t deg. is $1.457\,[1-(t-15.5)\times 0.00041$ volts. Assuming Clark's valuation, 1.457 volts at 15.5 deg. C, as the normal E.M.F., to be exact. Some observations were made with similarly prepared cells containing zinc mercuric sulphate (turpetts mineral). These exhibited no great degree of constancy, six giving values varying from 99.4 to 100.6 (an average Clark's cell being, as before, 100) when newly prepared; and sank to below 99 in the course of a week or two to about 96 after some months. This result shows that mercuric sulphate is not so good for the purpose of a standard cell as mercurous sulphate; but, according to Dr. Wright, the presence of traces of mercuric sulphate in the mercurous sulphate used for the Clark's cell does not appear to exert any influence on the permanence of the latter.

Phonography as a Study.

To dilate on the advantages of phonography is simply to repeat what is self-evident to the most superficial observer. It takes its place with the telegraph, telephone and other like discoveries as indispensable in the whirl and bustle of active business life.

There are many systems, each having its special advocates, many of whom are so prejudiced that though art and science are admittedly progressive, yet in this instance it would seem, judging by some of the screeds published, that there remains in this study nothing that can be improved, only traverse the old beaten track of their favorite theory, if you wish to know anything worth knowing.

Electric Lighting Considered from a Sanitary Point of View.

[Abstract of a paper read at the Congress of the Sanitary Institute of Great Britain, held in Dublin this month.]

The author hopes to be able to show that the question of artificial lighting, and especially electric lighting, has a most important bearing on sanitation, although hitherto it has not received very serious attention from this point of view. When we reflect what a considerable portion of time is spent by modern society under light other than natural light, and how much more injurious are all modes of artificial lighting in comparison with sun-light, it is essential that we should anxiously consider the most desirable form of light which shall exercise the least ill effects on our bodily health and comfort.

Since the object of this paper is to consider the subject of electric lighting from a sanitary point of view, and since it was only with the general introduction of gas and petroleum the danger of injury to health arose, it is not necessary to dwell on the forms of lighting in vogue prior to the illuminants now so universally used.

The conditions of life under all kinds of artificial light are less favorable to health than under daylight. Under artificial light these conditions are completely altered; light which would be considered excessive at night is far inferior to ordinary daylight. The heat produced by all forms of light exceeds the temperature of the atmosphere in average daylight, and the air is vitiated to an extent proportional to the amount of light produced. How desirable, therefore, is it that we should seek, and by every effort in our power assist in, the development of that form of artificial light which approaches nearest the conditions existing under sunlight.

As will be seen hereafter, the light afforded by means of electricity is far superior to all other illuminants in the fulfillment of these conditions.

Gas, for example, the chief constituent of which is a combination of carbon and hydrogen, will not burn without the aid of the oxygen in the atmosphere. In the process of combustion the particles of carbon contained in the gas come into contact with the oxygen of the air, and float in an incandescent state into the interior of the burning vapor, and this constitutes the flame. The presence of the carbon in a finely-divided state may be easily shown by holding some refractory substance in the flame, when the carbon will be deposited upon it in the form of soot.

Should, however, the supply of oxygen

be insufficient, partial combustion only takes place, the carbon escaping in an unburnt condition in the form of a dark cloud, when the flame is said to smoke.

The brightness of the flame therefore depends on the supply of air necessary for perfect combustion.

The light afforded by candles and lamps does not differ essentially fromt hat of the ordinary gas burner. The same elements which constitute the one are present in the other—they all owe their luminosity to combustion. A petroleum lamp burns imperfectly without a chimney, but when this is put on, a strong draft is caused, supplying the air necessary for thorough combustion, and the brilliancy of the flame is thus materially exalted.

From what has been said it is obvious that in order to obtaiu the highest illuminating power of a flame, a plentiful—and what is more, a fresh—supply of air is essential. Moreover, in the process of combustion the air is contaminated with certain poisonous compounds, such as carbonic acid, carbonic oxide, and sulphur, which when breathed even in a limited quantity, are injurious to the human frame. Another effect of combustion is the production of vapor, formed by the oxygen of the air combining with the hydrogen, which constitutes a portion of the material consumed.

As has been already pointed out, gas not only deprives the air of its health-giving oxygen, but it contaminates it with poisonous compounds which are more or less—according to the extent to which they exist—injurious to animal life. Dr. Tidy considers that the contamination of the atmosphere in a crowded theater at the end of the performance may be regarded as distressing, and many of us experience disinclination to go to the theater because of the inconvenience suffered from the heat and vitiation of the air caused by the gas, producing headache and, oftentimes, giddiness. The effects of heat and vapor from combustion will be readily detected in a wareroom or shop, the lower portion of which may be only at a temperature of 60° to 70°, in consequence of the hot air ascending, the temperature near the ceiling will probably be from 130° to 140°. When, therefore, goods, books, etc., are placed in such high localities it cannot be wondered at that they become injured or destroyed. Indeed, referring to the amount of water generated by the gas flame, it is stated on authority that sixty gas jets will produce on the lowest computation two gallons of water per hour. Thus it is we often see on a December evening streams of water trickling down the windows of shops brilliantly lighted by gas.

Electric lighting by incandescence produces absolutely none of the evil effects just enumerated. There is no oxygen consumed, no carbonic acid or other compounds given off, and, consequently, there is no vitiation whatever of the atmosphere; and, as to the heat-producing effects, the air of a room lighted by gas is twenty times more heated than if lighted by incandescent electric lamps. From this it will be readily seen how conducive to health and bodily comfort are the conditions fulfilled by electric light in contrast with all other illuminants. And not only is the health and bodily comfort affected by the influence of artificial light, but the temperament also; and it is very remarkable to notice the difference in the effect produced by gas light, and electric light, on the spirits of those obliged to work long hours at night. A brilliant light, we all know, exercises a cheerful influence on the animal spirits, and electric lighting affords unusual facilities for acquiring a higher degree of illumination without the accompanying heating and air-vitiating evils inseparable from gas and petroleum.

The glare of the electric light is commented on as being objectionable; but this is only applicable to the arc light, and even this form readily admits of being shielded in ground globes; and as it is only suitable for outdoor use and for large buildings, it is not necessary here to say much about it. A strange story was told in the newspapers a few days ago, of a boy, aged about 14 years, who, for a wager, stared at the sun for some time and died the same night in great agony. Professor Pickering, a German *savant*, recently made an investigation into the cause of weak sight amongst the students of his university, and traced it to the heat given off by their reading lamps, which dried up the humors of the eye. Seeing that the electric light gives off but a trifling degree of heat, it is, therefore, far preferable in this respect, and far less injurious to the sight than gas, oil, or candle light.

Many institutions throughout the country are now lighted by electricity, and in every single instance with the most beneficial results to the health and comfort of the people who work by its aid.

It would be impossible in a small space to describe the lighting arrangements in these institutions, but the author may be permitted to refer to one installation which has been working under his charge for the past nine months, and which will serve as an illustration for many others. The installation referred to is that of the offices of the *Irish Times*. The composing room here forms one large apartment measuring some 60 by 70 by 40 feet in height. Before the introduction of the electric light, this apartment was lighted by 100 gas jets, and, remembering that one gas jet consumes as much oxygen as five individuals, and adding to this the effects resulting from the breathing of the compositors, together with the long hours of night during which the work is carried on, we can readily conceive how extremely unwholesome and unhealthy must have been the air of this apartment. Indeed, as a matter of fact, the employes frequently suffered from ill health and discomfort, which they usually attributed to the vitiated state of the atmosphere, and it was not unusual to have several out on sick leave at one time. This was especially noticeable in summer. The temperature of the apartment frequently ran as high as 85° in winter, and 95° in summer. The discomfort occasioned sometimes in summer was very serious indeed, oftentimes rendering it impossible for some of the men to carry on their business for the usual number of working hours.

Since the introduction of the electric light the condition of things is entirely changed. The atmosphere is pure and healthy, the thermometer rarely marks higher than 70° during the night, the light is bright and perfectly steady in its action, the health of the employes is good, and their spirits cheerful and buoyant, many of them being able to work for considerably longer hours now then formerly, and the sick list has all but disappeared.

This proves that not only from a sanitary, but also from a commercial point of view, is the introduction of the electric light beneficial.

It may be argued that a proper system of ventilation would render the use of gas harmless; but the question of ventilation, although apparently so simple, is difficult to deal with. With the electric light the difficulty of ventilation is reduced to a minimum.

Amongst other advantages of the electric light which, although not strictly relating to its sanitary aspect, have nevertheless an indirect effect on health, may be mentioned the following: Plants grow in rooms lighted by it, and cut flowers exhibit their true colors, and do not quickly wither; paintings show their natural tints and colors to better advantage. Its influence on the health of children is incalculable. An electrically-lighted nursery, even if the light remains on all night long, is free from the noxious vapors produced by candles or gas. The electric light also lends itself to artistic treatment in the most admirable way.

In the adoption of the electric light, therefore, we fulfill the following important considerations: We do not deprive the air of oxygen, so necessary for our health and comfort; we do not adulterate the air with pernicious compounds of any kind; we avoid the accumulation of vapor; only a small degree of heat is produced; and we facilitate the means of ventilation.

So long as electric lighting is carried on in isolated installations, it will be fonnd difficult, no doubt to compete with its older rival, although there are cases where the cost of such installations compares favorably with gas. The expense of maintenance by isolated lighting is governed entirely by local considerations. Where the light is required only to a limited extent—say 100 incandescent lamps burning for less than 1,000 hours per annum—the cost will probably exceed that of gas; but where the number of lamps reaches 200 and the number of working hours amounts to about 2,000 per year, then electricity will undoubtedly beat gas. It is, however, unfair to compare the expense of lighting by isolated installations with that of lighting by means of a well-established and elaborate system, whose existence is founded on the experience of half a century. However, in considering the question of expense, the superior advantages which we have endeavored to point out, inherent in the electric system, should entitle it to a higher price than all other systems of artificial illumination.

The time will come, however, when the electric current will be supplied on a large and comprehensive scale, and when its merits will be fully appreciated by all; then the question of cost will no longer form an insuperable barrier to its universal adoption.

A discussion followed and Sir Robert Rawlinson, in summing up, spoke as to the purity, brilliancy, and wholesomeness of the atmosphere wherever the electric light was used. He thought that its advantages over all other illuminants would sooner or later recommend its universal adoption, but there were still difficulties to be got over in order to make it a perfectly safe and certain means of illumination. He referred to the fact of its having gone out at the Health Exhibition, where it was worked under the most favorable conditions, and also alluded to the unfortunate accident which occurred the other day, resulting in the death of one of the attendants on a dynamo used for arc lighting.

Mr. Fahie, in reply, said that no doubt there were still some difficulties which impeded the successful and economical application of electric lighting, but it should be remembered that difficulties had always to be overcome in the introduction of every new industry; and those attending electric lighting were being removed from time to time, as electricians gained experience by actual practical work. As to the accident at the Health Exhibition, it simply arose from the attendant incautiously placing both his hands at one time on the opposite brushes of the dynamo, thus receiving through his body the current which was being generated to feed 30 arc lamps. It appears that the unhappy man had been cautioned against placing both hands on the machine, and the accident was wholly due to negligence.—*J. A. Fahie, C.E.*

M. Chervet describes, in the first place, a modification of the capillary electrometer, which he uses in his experiments. He takes an L shaped glass tube, expanded above so as to form a vessel and with a conical point, and introduces it with its horizontal end into a second similar vessel filled with dilute sulphuric acid, into which mercury is poured below, whilst the electrode passes out at the lower end. The vessel at the top of the tube is filled with mercury, and contains the second electrode. The change of level occasioned by an electromotive force is compensated by pressure, which is read off on a sloping water-manometer. With this apparatus the author has measured in two points the potential difference between two parts of a very flat rectangular trough filled with solution of sulphate of copper. Through this trough is passed a current by means of two cylindrical copper electrodes, immersed at the extremities of one of the short sides. One of these two electrodes is immersed in the middle of one of the short sides of the trough, whilst the other is at any other arbitrarily selected part of the trough, determined by its distance from such short side, and from the longitudinal median line of the trough. A long, tall, rectangular trough is also used, and on passing the current through it longitudinally, the potential difference is calculated and observed at two points arranged in a similar manner on the surface of the trough.—*Wiedemann's Beiblatter.*

ELECTRIC LIGHT NEWS

—— It is announced that it is proposed to light the city of Rotterdam by means of a system of distribution with accumulators. After the failure of an analagous trial made in Paris during last year, it would be prudent to await the results of the experiments on a grand scale, which are now being made in Colchester, England, before giving a definite opinion on the probable result of enterprises of this nature.

—— Since the oil lamps in the light-houses at Planier (mouths of the Rhone), have been replaced by the electric light, the new and brilliant illuminant, has attracted quails by the dozen. Wild geese and wild ducks are also fascinated by the electric light, and in a single night the nine windows of the light-house at Cape Ferret have been broken to pieces by wild fowl. In the Brechut light-house a wild goose, after having broken and passed through the glass, fell into the lamp. The equipage of a floating English light captured one thousand quail during the space of one night, and it was found necessary to protect the light by a grating.

—— At the last meeting of the Engineers' Club of Philadelphia, Mr. C. Henry Roney showed a portable storage battery for mining and exploring purposes, with small incandescent lamps, illustrating his remarks with blackboard sketches. The battery shown was a modification of Plante's, devised by Dr. E. T. Starr, of Philadelphia, the electrodes consisting of V-shaped plates of sheet-lead arranged over each other, the convexity downward, with a slight interval between them, their ends attached to a lead frame by "burned" joints, the interstices between the plates being filled with finely divided metallic lead, exposing a large surface to oxydation and reduction when subjected to dynamic-electric or voltaic energy, and, in turn, giving off a large percentage of the "stored" energy to incandescent lamps placed in the circuit. The battery shown measured 3¼ inches long, 2¾ inches high, and ¾ inch thick, and would maintain a small two-candle incandescent lamp at incandescence for about one hour. A battery sufficiently large to run an eight-candle lamp for ten or twelve hours would not be too large or heavy to carry conveniently for mine or other underground exploration.

—— A very satisfactory trial was made recently of the electric lighting apparatus on board the Colossus at Portsmouth. This is the most perfect and comprehensive installation which has yet been introduced on board a ship of war, the whole vessel, even to the remotest corner, having been brought under the influence of the new illuminant. In addition to the complete lighting of the ship below decks by incandescent lamps, the installation includes the fitting of three powerful search lights, as well as incandescent yard-arm lights. The system adopted is that of the Anglo-American Brush Company, and it has been carried out under the direction of Mr. W. J. Fitze, the assistant constructor in charge of the ship. The interior illumination is effected by 150 lights of 20, and 240 lights of 10 candle-power, the lamps being also manufactured by the Brush company. The current is produced by three Victoria dynamos, coupled to Brotherhood engines. The test mentioned consisted in running the machinery for six hours continuously, with a full load of 180 amperes and an electromotive force equal to 80 volts. The dynamos rotated at the rate of 400 revolutions a minute, with 40 lbs. pressure of steam. The trial was witnessed by representatives from the departments of the Comptroller of the Navy and the Director of Naval Ordnance, Mr. Barnaby, senior constructor, and other dock-yard officials.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING NOVEMBER 4, 1884.

307,437 Pneumatic dispatch tube; Henry Clay, Philadelphia, Pa.

307,461 Secondary battery; Arthur S. Hinckley, Montreal, Quebec, Canada, assignor by mesne assignments to the Electric Amalgam Company, of Maine.

307,462 Secondary battery; Arthur S. Hinckley, Montreal, Quebec, Canada, assignor by mesne assignments to the Electric Amalgam Company, of Maine.

307,463 Secondary battery; Arthur S. Hinckley, Montreal, Quebec, Canada, assignor by mesne assignments to the Electric Amalgam Company, of Maine.

307,478 Electric battery telephone; Thomas D. Lockwood, Malden, Mass.

307,494 Electric call; David H. Rice, Lowell, Mass., assignor to the Currier Bell Telephone Company, of Massachusetts.

307,498 Electro-magnetic pole changer; John E. Smith, New York N. Y., assignor to the Gold and Stock Telegraph Company, same place.

307,517 Detonating and visual signal for railways; Eugene W. Applegate, Washington, D. C.

307,534 Car-brake; Henry Flad, St. Louis, Mo., assignor to the Electro-Magnetic Brake Company, of East St Louis, Ill.

307,535 Railway car-brake; Henry Flad, St. Louis, Mo., assignor to the Electro-Magnetic Brake Company, of East St. Louis, Ill.

307,536 Railway car-brake; Henry Flad, St. Louis, Mo., assignor to the Electro-Magnetic Brake Company, of East St. Louis, Ill.

307,543 Electro-magnetic thermoscope; Henry J. Haight, New York, N. Y.

307,584 Electric arc lamp; John M. Pendleton, New York, N. Y., assignor to the Equitable Electric Company, same place.

307,639 Electrical circuit protector; Ezra T. Gilliland, Boston, Mass., assignor to the American Bell Telephone Company, same place.

307,683 Electric arc lamp; Robert J. Sheehy, New York, N. Y.

307,684 Regulator for dynamo-electric machines; Robert J. Sheehy, New York, N. Y.

307,690 Regulator for systems of electric distribution; William M. Thomas, Grand Rapids, Mich., assignor of one-half to the Grand Rapids Electric Light and Power Company, same place.

307,696 Printing telegraph; Aloys Wirschong and Emil Wirsching, Brooklyn, N. Y.

307,699 Induction coil; James Allen, Washington, D. C.

307,728 Speaking telephone transmitter; Thomas J. Perrin, New York, N. Y., assignor to the National Improved Telephone Company, New Orleans, La.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. ELECTRICAL REVIEW PUBLISHING CO., Box 3,329. 23 Park Row, New York.

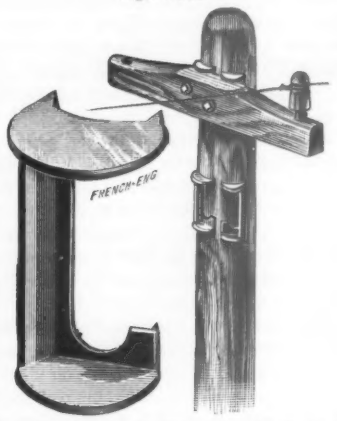
Neatly-bound volumes (half-yearly) of the ELECTRICAL REVIEW will be sent, postage prepaid, on receipt of $3; also the latest improved self-binders for the ELECTRICAL REVIEW, or any other electrical or scientific journal published in this country, for $1. ELECTRICAL REVIEW PUBLISHING CO., 23 Park Row, New York. N. Y.

J. H. LONGSTREET,
9 Barclay St., New York,
Manufacturer and Dealer in
TELEGRAPH INSTRUMENTS
Telephone and Telegraph Supplies
—OF EVERY DESCRIPTION.—
ANNUNCIATORS and BURGLAR ALARM APPARATUS, BATTERIES and BATTERY MATERIAL.
Telegraph Instruments for Railroad Use a Specialty.

OKONITE
NEW YORK INSULATED WIRE AND VULCANITE CO.
13 Park Row, New York.

Hard Rubber for ELECTRICAL PURPOSE.

PATENT PORTABLE AND ADJUSTABLE
CROSS ARM HOLDER
Especially adapted for Telephone and Electric Light Poles.

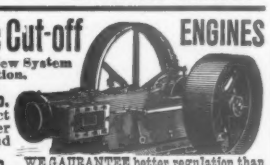


Among the many advantages in using the Cross Arm Holder are the following:
It does away with cutting gains in poles, as is done at present; and thereby weakening the wood.
It gives a larger bearing to the cross arm. On a six inch pole it gives fully eight inches, and greater bearings on poles of larger dimensions.
It is easily adapted to standing poles.
It prevents decay to the poles and cross arms at the gain.
A cross arm with this holder is easily raised or lowered upon the pole without disconnecting wires from the insulator by merely withdrawing the screws.
It will hold an arm of any length without other support.
For information and circulars, apply to
WM. KLINE, Supt. Teleg.
TOLEDO, O.

WANTED.
Electro-Technical Engineer
of learning and experience wants a responsible and renumerative position. Address
ELECTRICIAN,
Care of ELECTRICAL REVIEW.

WANTED.
A young man experienced in the manufacture of incandescent electric lamps, in all its details, also in erecting plant for same, good draftsman and chemist, wants a position where his knowledge will be useful. Address
"A. B. C.,"
Electrical Review.

Automatic Cut-off ENGINES
Embodying a New System of Regulation.
THE GOVERNOR WEIGHS THE LOAD.
The most perfect governing ever obtained. Send for circular F.
BALL ENGINE CO., ERIE, PA.



WE GAURANTEE better regulation than it is possible for any other ENGINE to give.

A NEW AND SUBSTANTIAL
BUSINESS INDUSTRY.
Large Profits to First-class Business Men.

The Thomson-Houston Arc and Incandescent System of Electric Lighting is universally acknowledged to be the most perfect and economical ever invented.

Local Companies cannot afford to use any other.

Companies now using this system are making large profits on their investments.
Complete Central Lighting Stations for City and Commercial Lighting, with Boilers, Injectors, Heaters, Armington & Sims' high-speed Engines and Wire lines, will be contracted for and constructed by the American Electric and Illuminating Co., 197 Congress Street, Boston, Mass., in any city or town in the United States where exclusive territory has not already been ceded.
To active and responsible business men, who can command a portion of the necessary capital to build central stations and secure business for same, this Company will furnish the remaining capital upon liberal terms. Address
EDWARD H. GOFF, President.

NOW READY.
Dynamo-Electric Machinery
A MANUAL FOR STUDENTS OF ELECTROTECHNICS.
—BY—
SILVANUS B. THOMPSON, B. A., D. Sc.
408 pages, 8vo., cloth, illus. by 230 engravings.
Price, $5.00.
Descriptive Catalogue of Electrical and other Books sent free on application.
E. & F. N. SPON, 35 Murray St., N. Y.

Edward P. Thompson, M.E.
Member { American Society of Mechanical Engineers. American Institute Electrical Engineers.
Electrical Expert
13 PARK ROW, NEW YORK.

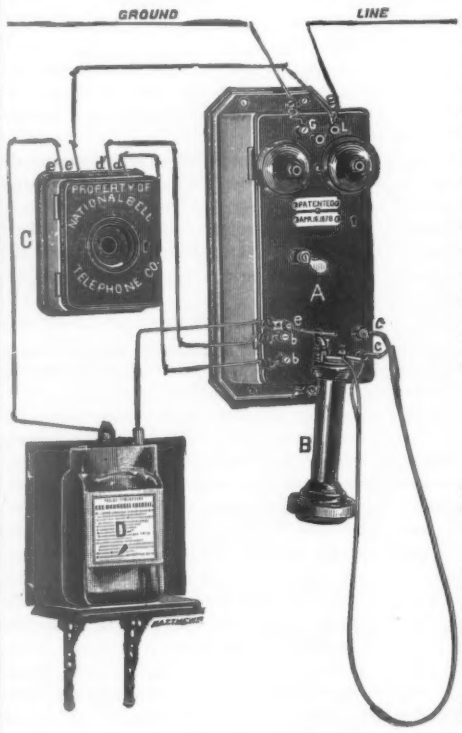
PAINE & LADD,
HALBERT E. PAINE, Late Commissioner of Patents. STORY B. LADD.
Attorneys in Patent Causes
And Solicitors of Patents,
WASHINGTON, D.C.

CONNOLLY BROS.,
Patent Attorneys
AND SOLICITORS,
MORSE BUILDING,
Cor. Nassau & Beekman Streets,
NEW YORK.
PHILADELPHIA, PA.,
Mutual Life Insurance Building,
10th AND CHESTNUT STREETS.
WASHINGTON, D. C.
CORNER 6th and F STREETS.
ELECTRICAL CASES A SPECIALTY.

THE THOMSON-HOUSTON ELECTRIC CO.
Principal Office, 131 Devonshire St., Boston, Mass.,
FURNISHES THE
ONLY PERFECT AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.
In all desirable qualities of ELECTRIC ARC LIGHTS the THOMSON-HOUSTON SYSTEM has no equal. The Lights are *superior in color and steadiness*, and the entire apparatus is more *economical*, *efficient* and *safe*, more *easily managed*, and *less liable to derangement* than any other.
THE THOMSON-HOUSTON ELECTRIC CO. was awarded the FIRST PRIZE for the *best system* of arc lighting, and the *best Arc Lamp*, at the Cincinnati Industrial Exposition of 1883.
The Thomson-Houston System has been awarded *superiority in all the competitive tests* to which it has been subjected. NEW ILLUSTRATED PAMPHLET will be sent on application.

I. W. COLBURN & Co. MFG. OF Dynamo-Electric Machines 131 MAIN ST. Fitchburg, Mass. SEND FOR CATALOGUE.

THE
American Bell Telephone Co.
WM. H. FORBES, *President.* THEO. N. VAIL, *Gen'l Manager.* WM. R. DRIVER, *Treasurer.*



This Company owns the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controls, except for certain limited territory, under an arrangement with the Western Union Telegraph Co., the Gold and Stock Telegraph Co., the American Speaking Telephone Co., and the Harmonic Telegraph Co., the Patents owned by those Companies, and is prepared to furnish telephones to the citizens of the United States through its local Licensees, on the following systems:

EXCHANGE,
PRIVATE LINE, &
SPEAKING TUBE LINES

Those desiring instruments on Private or Speaking Tube Lines, or connections on Exchanges, will please apply to the nearest Licensed Exchange, when their case will be brought to the attention of the proper local Company.

Any further information will be gladly furnished on application to the Company at its office,

No. 95 MILK STREET, BOSTON, MASS.

All persons using telephones not licensed by this Company, are hereby respectfully notified that they are liable to prosecution, and for damages for infringement, and will be prosecuted according to the full extent of the law.